Distribution and Abundance of Dall's Sheep in the Richardson Mountains, August 2003

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ABSTRACT

Aerial block surveys (blocks established in 1984) were conducted during 16 to 31 August 2003 to document the number and distribution of Dall's sheep (*Ovis dalli*) in the Richardson Mountains, Northwest Territories (NWT) and Yukon Territory (YT), Canada.

We counted and classified 757 sheep including 429 nursery sheep, 121 lambs, 177 rams (35 half curl, 41 three-quarter curl and 109 full curl) and 29 unclassified sheep. The annual rate of decline for the non-lamb portion of the population was 14% during 2001 to 2003; this population decline began during 1997 to 2001. There were 28.2 lambs per 100 nursery sheep indicating that productivity or lamb survival increased between 2001 and 2003. The numbers of rams decreased from 373 in 2001 to 177 in 2003 or by about 52%. Given the low number of rams observed, declines in the number of full curl rams can be expected over the next few years. Overall 72% of the sheep were observed in the NWT.

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INTRODUCTION

The Dall's sheep (*Ovis dalli*) in the Richardson Mountains are part of an island population at the northernmost extent of their distribution in Canada (Barichello et al. 1987). These sheep and those in the British Mountains, Yukon Territory (YT), are the only populations in Canada that inhabit ranges north of the Arctic Circle and are exposed to rigorous Arctic environments (Barichello et al. 1987). The Richardson Mountains Dall's sheep population is largely unhunted. Gwich'in and Inuvialuit harvest a small number of sheep, primarily ewes and lambs, each year. Some residents of Aklavik have expressed an interest in conducting guided sheep hunts for non-resident hunters since the late 1980s. The Gwich'in Renewable Resource Board (GRRB), the Department of Environment and Natural Resources (ENR), Government of the Northwest Territories, and the Department of Environment, Yukon Territorial Government, currently survey this population every three to five years to monitor population trends and productivity.

A number of surveys of this population were conducted by biologists between 1971 and 1986 (Simmons 1973, Hoffman 1974, Nolan and Kelsall 1977, Hoefs 1978, Males 1980, Latour 1984). Population estimates obtained during these surveys suggested that the population had declined from 447 in 1972 (Nolan and Kelsall 1977) to 68 in 1983 (Latour 1984). Barichello et al. (1987) estimated that there were 543 sheep in the area in 1984. As a result, the suspected decline in sheep numbers between 1972 and 1983 may have been a function of survey methods or area surveyed, or both. Barichello et al. (1987) re-surveyed the area in 1985 and 1986 and found that the population had increased to an estimated 617 sheep in 1985 and 802 in 1986, indicating a period of rapid population growth.

This population was surveyed again in 1991, 1997, and 2001 (Nagy and Carey 2013a; Nagy and Carey 2013b; Nagy et al. 2013). Three blocks (Bell, Millen, and White) were not surveyed in the Yukon in 1997 Nagy and Carey (2013b). As a result, Nagy and Carey (2013b) summarized the 1984, 1985, 1986 and 1991 data for the blocks surveyed in 1997. These data indicate that the population had continued to increased between 1991 and 1997, but the annual rate of growth had declined. The lamb to nursery sheep ratios were indicative of stable to increasing populations in 1991 and 1997. The number of full curl rams in the population increased dramatically from 50 in 1986 to 182 and 136 in 1991 and 1997, respectively. By 2001 the population had declined from an estimated 1,730 in 1997 to 1,057 in 2001 (Nagy et al. 2013). The lamb to nursery sheep ratios declined from 31.2 lambs per 100 nursery sheep in August 1997 to 11.1 lambs per 100 nursery sheep in June 2001 in the blocks that were surveyed in 1997, indicating a declining population (Nagy et al. 2013). The number of full curl rams also declined from 182 in 1991 to 133 in 2001 (Nagy et al. 2013).

In August 2003 we surveyed the study area established in 1984 (Barichello et al. 1987). There were three primary objectives of this survey:

1. Obtain current estimates of the numbers of lambs, nursery sheep, and rams (half, three-quarter, and full curl) in the populations.
2. Document the distribution of rams in the population during mid to late summer.
3. Obtain information that is required to determine the number and distribution of hunting permits within management zones allowable if limited entry sport hunts occur in the future.

This survey was conducted by ENR, Inuvik, NT, in cooperation with the GRRB, Inuvik, NT and the Department of Environment, Dawson, YT.

Study Area

The northern Richardson Mountains (67°30' to 68°30' N, 135°30' to 137° W) are in the "Northern Mountains and Coastal Plain" ecological region (Oswald and Senyk 1977) also called the Cordillera ecological region in the NWT (ECG 2010) (Figure 1). The central portion of the area is characterized by sharp ridges, rocky slopes and deep V-shaped valleys, and surrounded by gently rolling terrain. Most of the study area is over 1,500 m above sea level and is composed primarily of sedimentary rock. Permafrost is continuous, temperatures average -9°C annually, and annual precipitation is about 500 mm (Barichello et al. 1987).

The study area is approximately 3,000 km^2 (Figure 2). Black spruce (*Picea mariana*) and balsam poplar (*Populus balsamifera*) occur in protected valleys. Tussock tundra (*Carex* spp. and *Eriophorum* spp.) dominates valley bottoms to mid-slopes (Barichello et al. 1987). Alpine vegetation dominates ridge tops at higher elevations. Barichello et al. 1987 suggested that 50% of the area could be considered potential sheep habitat with most of this occurring above the tree line where forage and escape terrain are available.

Moose (*Alces americanus*) occur in low numbers throughout the eastern portion of the study area but are generally found along valley bottoms. The Porcupine caribou herd (*Rangifer tarandus granti*) migrates through the area during spring and autumn (Porcupine Caribou Technical Committee 1993). In some years a portion of this herd summers and winters in the area. A few muskoxen (*Ovibos moschatus*) have been observed. Grizzly bears (*Ursus arctos*), wolves (*Canis lupus*), wolverine (*Gulo gulo*), and golden eagles (*Aquila chrysaetos*) are relatively common.

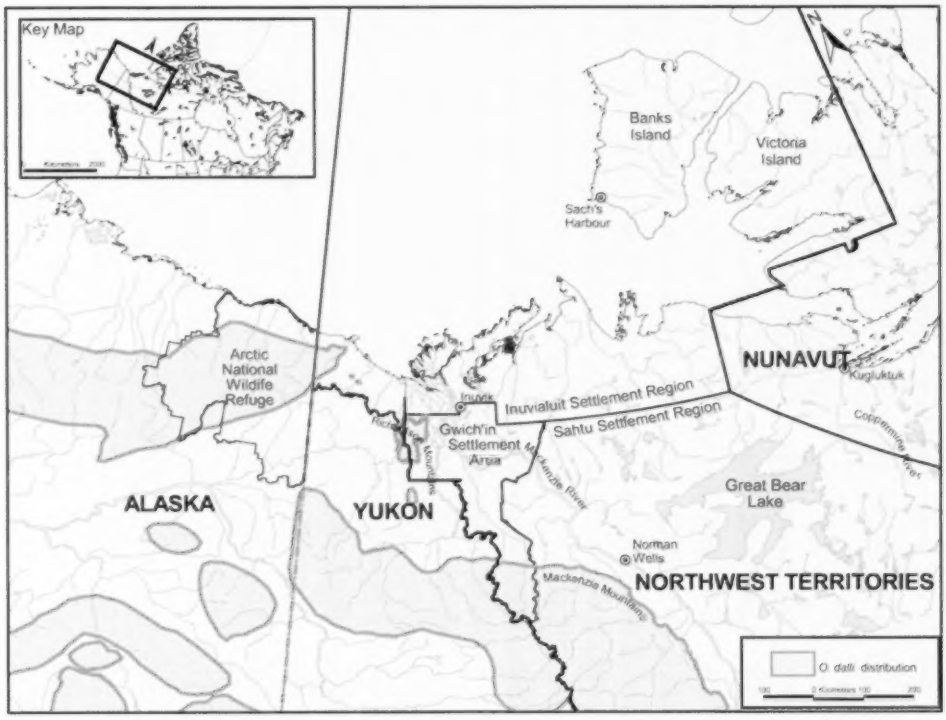

Figure 1. Location of the northern Richardson Mountains Dall's sheep study area.

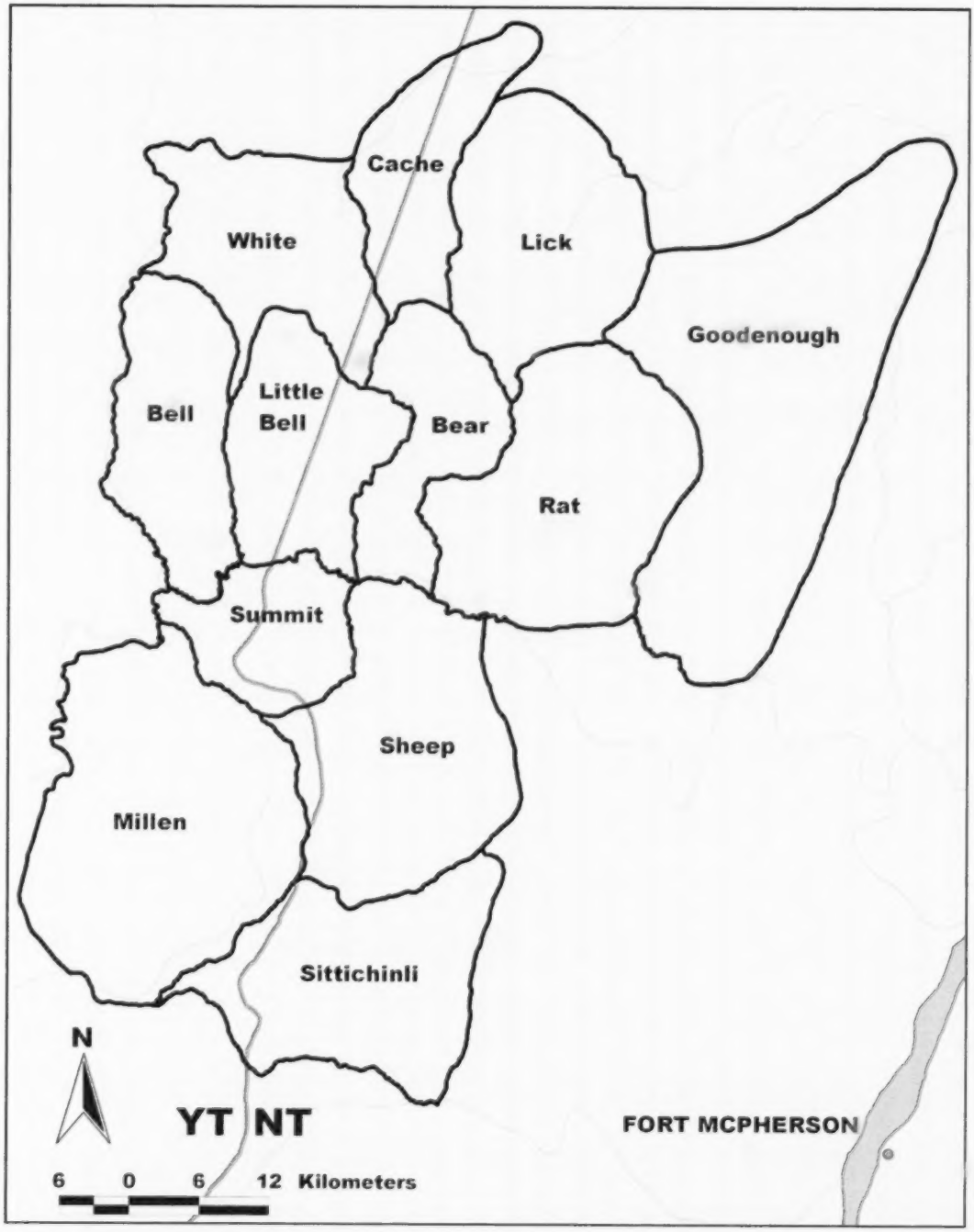

Figure 2. Blocks surveyed in the northern Richardson Mountains, August 2003.

METHODS

The study area was subdivided into mountain blocks to facilitate a systematic survey and analysis of survey data (Figure 2). Complete coverage was obtained by contouring mountain blocks and river drainages using a helicopter flying at approximately 100 km/h and 200 m above ground. Sheep were counted and classified by sex and age class as follows: nursery sheep (ewes, yearlings, and two-year-old rams), lambs, and rams (half, three-quarter, and full curl). Nursery groups were classified as yearlings, young rams, and ewes whenever possible. The number of sheep in each group and sightings of other wildlife including grizzly bears, golden eagles, wolves, caribou (*Rangifer tarandus*), moose (*Alces americanus*), and muskoxen were recorded. A GPS was used to record the longitude and latitude coordinates of each sighting and the tracks flown.

The number of lambs, nursery sheep, rams (half, three-quarter, and full curl), lambs per 100 nursery sheep, and rams (half, three-quarter, and full curl) per 100 nursery sheep was calculated for each block and for the population. These data were summarized as follows:

- for years when all blocks were surveyed (1984,1985, 1986, 1991, 2001, and 2003); and
- for the blocks surveyed in 1997 (Cache, Lick, Goodenough, Bear, Little Bell, Summit, Rat, Sheep, and Sittichinli) for years (1984,1985, 1986, 1991, 1997, 2001, and 2003)

The finite rate of population change was estimated as follows (Caughley 1980):

$$\log_e e^r = r$$

The distribution of lambs, nursery sheep, rams, and all sheep in the study area were mapped in ArcView 3.2 (Environmental Systems Research Institute).

RESULTS

The survey was flown on 26 to 31 August 2003. The lines flown during the survey are shown in Figure 3. Weather conditions were generally favorable during the survey, although high winds on 31 August 2003 prevented us from contouring the deeper ravines and canyons in the southeastern part of the Goodenough block. Appendices A through E provide details on all sheep, grizzly bears, caribou, moose, muskoxen, and golden eagles observed during the survey.

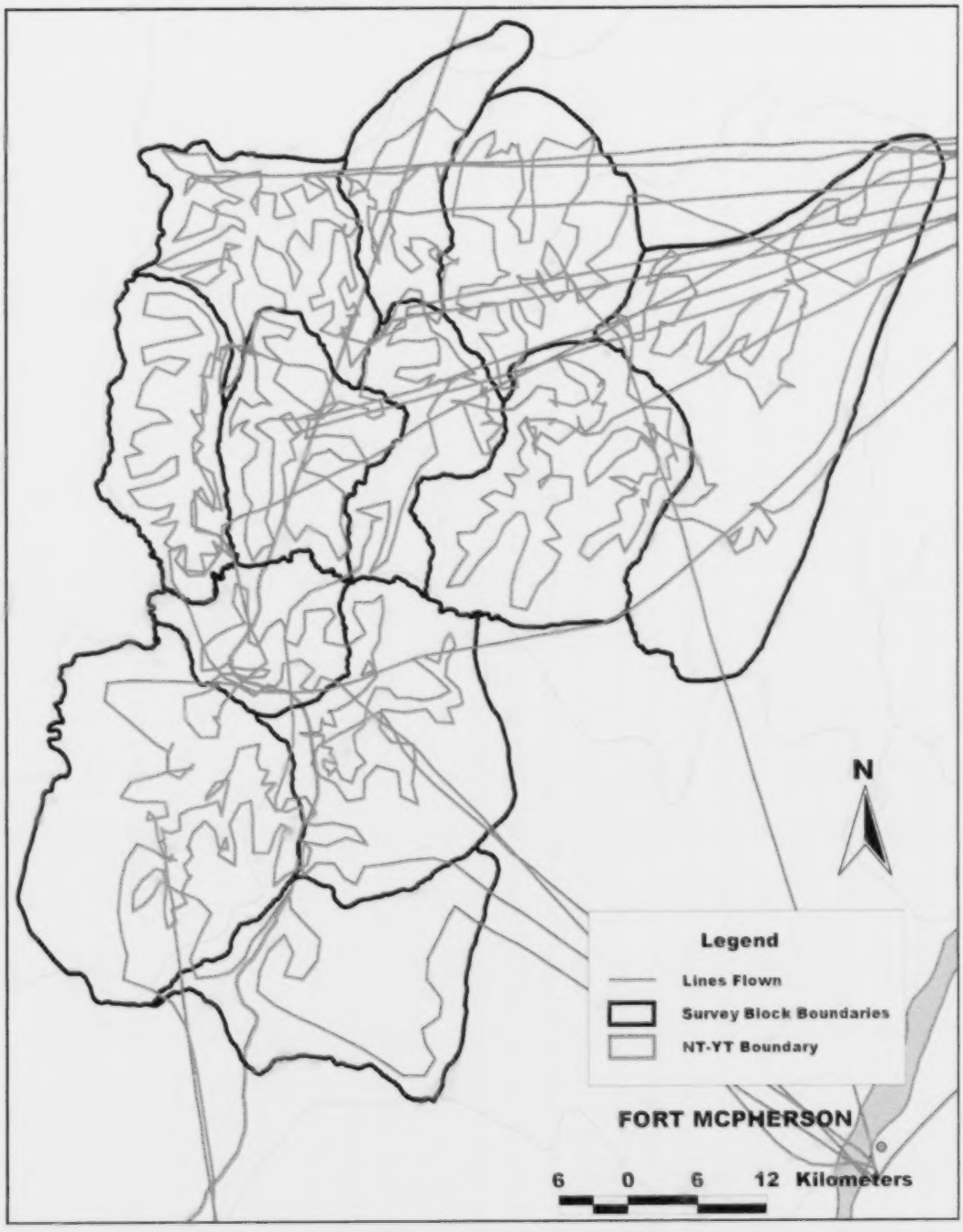

Figure 3. Lines flown during the northern Richardson Mountains Dall's sheep survey, June 2003.

Population Size and Trend

A total of 756 sheep were counted and classified in the study area including 429 nursery sheep, 121 lambs, 177 rams (35 half curl, 42 three-quarter curl, and 100 full curl), and 29 unclassified sheep (Tables 1 and 2). As a result, the population declined from 1,057 sheep in 2001 at an annual finite rate of -14% (Figure 4 and 5). These data further indicate that the decline that began during the period 1997 to 2001 has continued (Figure 4).

Table 1. Classification of Dall's sheep by survey block in the northern Richardson Mountains, August 2003.

Survey Block	Nursery Sheep	Lambs	Rams				Unclassified	Total Sheep
			Half Curl	Three-quarter Curl	Full Curl	Total		
Bear	19	6	6	3	2	11	0	36
Bell	10	2	2	3	5	10	0	22
Cache	29	6	1	2	0	3	0	38
Goodenough	143	30	6	8	21	35	25	233
Lick	34	7	1	1	2	4	0	45
Little Bell	19	6	6	10	11	27	0	52
Millen	52	21	4	6	11	21	0	94
Rat	55	21	2	6	24	32	0	108
Sheep	24	7	3	0	10	13	0	44
Summit	24	6	1	1	1	3	3	36
White	20	9	3	2	13	18	1	48
Sittichinli	-	-	-	-	-	-	-	-
Total	**429**	**121**	**35**	**42**	**100**	**177**	**29**	**756**

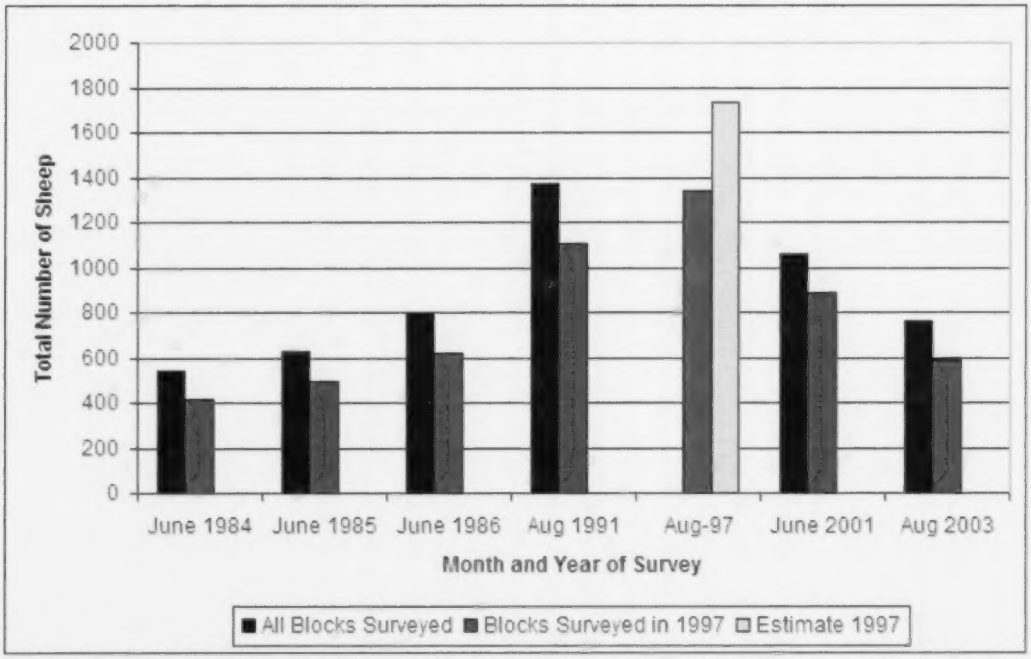

Figure 4. The number of Dall's sheep in the Richardson Mountains population during surveys conducted during the period 1984 to 2003.

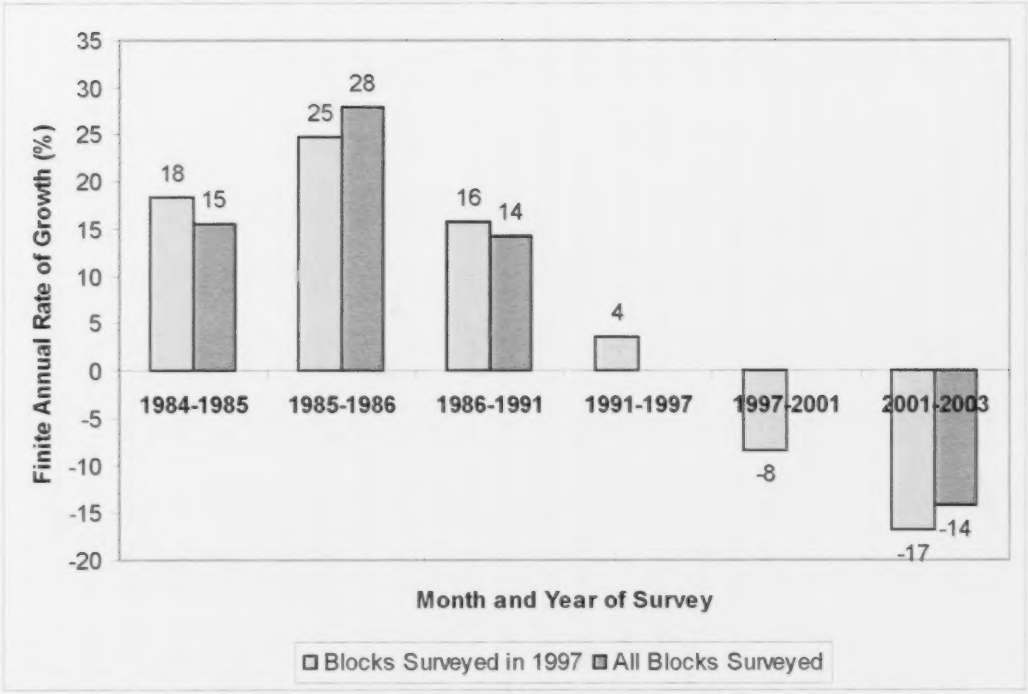

Figure 5. Finite annual rate of population growth for the Dall's sheep population in the Richardson Mountains during the period 1984 to 2003 (rates are based on changes in the number of sheep in the Cache, Lick, Goodenough, Bear, Little Bell, Summit, Rat, Sheep, and Sittichinli blocks only).

Productivity and Recruitment

Overall there were 28.2 lambs per 100 nursery sheep in August 2003 (Table 2). This value was 25.6 for the blocks in the 1997 study area (Table 3, Figure 6). Although these values are higher than those reported for 2001 (12.5 and 11.1 lambs per 100 nursery sheep, respectively), they were lower than those reported between 1984 and 1997 (Table 2 and 3). The 2003 values suggest that productivity or lamb survival has increased.

Table 2. Demographic characteristics of Dall's sheep by survey block and the northern Richardson Mountains study area, August 2003.

Survey Block	Lambs per 100 Nursery Sheep	Total Non-lamb Sheep	Percentage Full Curl Rams of Total Rams	Rams per 100 Nursery Sheep
Bear	31.6	30	18.2	57.9
Bell	20.0	20	50.0	100
Cache	20.7	32	0	10.3
Goodenough	21.0	203	60.0	24.5
Little Bell	31.6	46	40.7	142.1
Lick	20.6	38	50	11.8
Millen	40.4	73	52.4	40.4
Rat	38.2	87	75	58.2
Sheep	29.2	37	76.9	54.2
Summit	25.0	30	33.3	12.5
White	45.0	40	72.2	90
Total	**28.2**	**636**	**56.5**	**41.3**

The number of rams in the population declined from 373 in 1991 to 177 in 2003. Similarly, the number of half, three-quarter, and full curl rams declined during the period 1991/1997 to 2003 (Figures 7 and 8). The number of half curl rams in the population has declined from approximately 36.6% to 39.6% of the rams during 1984 to 1986 to less than 20% of the rams in the population during 2001 and 2003 (Table 3). In comparison the proportion of rams in the full curl class has increased from 34% to 37.4% of the rams during 1984 to 1986 to 57.6% to 55.9% of the rams during 2001 and 2003. Given the relatively low number of rams (n = 177) and the low number of half and three-quarter curl rams in the population in the population in 2003 (177 × 0.198 = 35), recruitment to the full curl ram class can be expected to be low during the next few years. As a result the number of full curl rams in the population will likely decline over the next few years.

Table 3. Demographic characteristics of the Dall's sheep population during years when all survey blocks were flown.

Year[1]	No. by Class			All Sheep	No. per 100 Nursery Sheep		Percentage of Rams		
	Lambs	Nursery	Rams		Lambs	Rams	Half Curl	Three-quarter Curl	Full Curl
1984[2]	110	302	131	543	36.4	43.4	36.6	25.2	37.4
1985[2]	117	362	148	627	32.3	40.9	31.1	33.1	34.5
1986[2]	145	460	197	802	31.5	42.8	39.6	25.4	34.0
1991[3]	289	675	373	1374	42.8	55.3	26.5	24.7	48.8
2001[4]	92	734	231	1057	12.5	31.5	18.6	23.8	57.6
2003	121	429	177	757	28.2	41.3	19.8	23.7	55.9

[1] The Bell, Millen, and White blocks were not surveyed in 1997. As a result the 1997 data were not included in this table.
[2] Barichello et al. 1987
[3] Nagy and Carey 2013a
[4] Nagy et al. 2013.

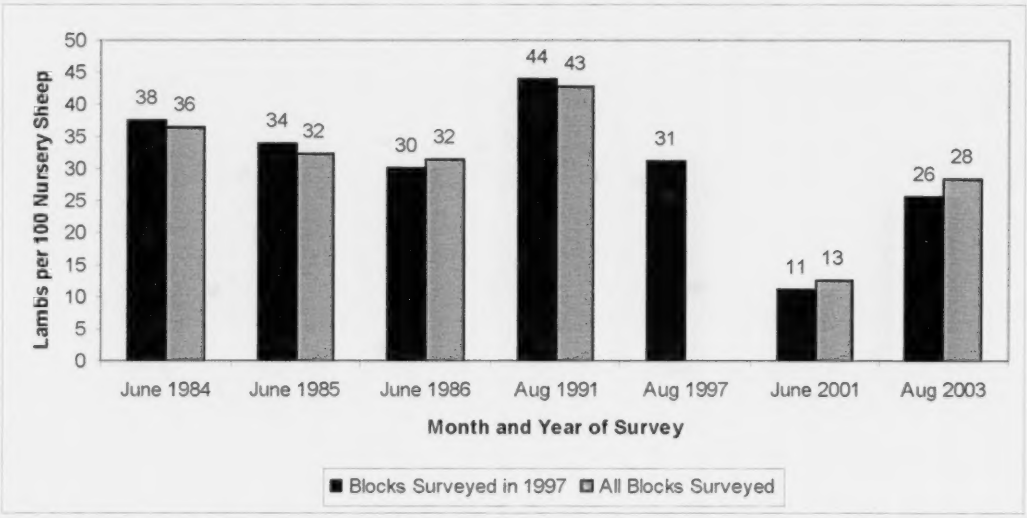

Figure 6. Number of lambs per 100 nursery sheep in the Richardson Mountains Dall's sheep population, 1984 to 2003.

Table 4. Demographic characteristics of Dall's sheep in the Richardson Mountains summarized for only those blocks that were surveyed in 1997.

Year[1]	No. by Class			All Sheep	No. 100 Nursery Sheep		Percentage of Rams		
	Lamb	Nursery	Rams		Lambs	Rams	Half Curl	Three-quarter Curl	Full Curl
1984[2]	87	232	100	419	37.5	43.1	38.0	26.0	35.0
1985[2]	100	295	101	496	33.9	34.2	23.8	34.7	39.6
1986[2]	111	371	137	619	29.9	36.9	35.8	26.3	36.5
1991[3]	246	561	260	1104	43.9	46.3	27.3	26.5	46.2
1997[4]	250	802	286	1344	31.2	35.7	26.6	25.9	47.6
2001[5]	71	637	182	890	11.1	28.6	20.9	26.4	52.7
2003	89	347	128	592	25.6	36.9	20.3	24.2	54.7

[1] Cache, Lick, Goodenough, Bear, Little Bell, Summit, Rat, Sheep, and Sittichinli blocks were surveyed in 1997.
[2] Barichello et al. 1987.
[3] Nagy and Carey 2013a.
[4] Nagy and Carey 2013b.
[5] Nagy et al. 2013.

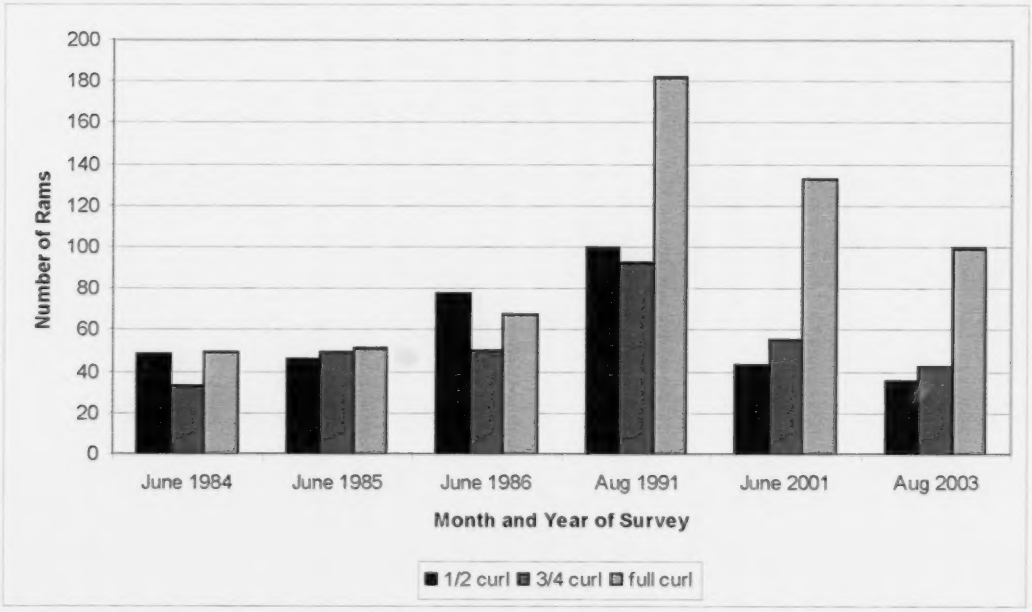

Figure 7. Number of half, three-quarter, and full curl rams in the Richardson Mountains population during years when all survey blocks were flown.

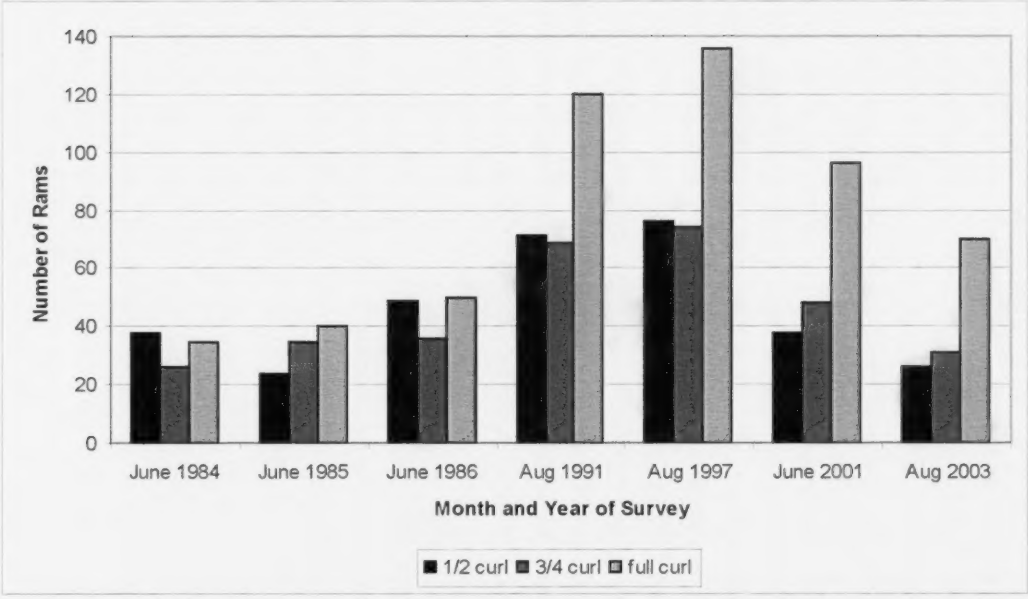

Figure 8. Number of half, three-quarter, and full curl rams in the Richardson Mountains population for blocks that were surveyed during 1997 flown.

Distribution of Lambs, Nursery Sheep, and Ram

The sites where we located lambs, nursery sheep, and rams in the Richardson Mountains during the survey are shown in Figures 9 through 12.

The proportion of the lambs found in each block surveyed during August 1991 and August 2003 is given in Figure 13. The majority of the lambs observed in 2003 were found in the Goodenough block (25%), followed by the Millen (17%) and Rat (17%) blocks. In comparison, the majority of lambs observed in 1991 were found in the Goodenough block (22%), followed by the Lick (15%) and Sheep (15%) blocks.

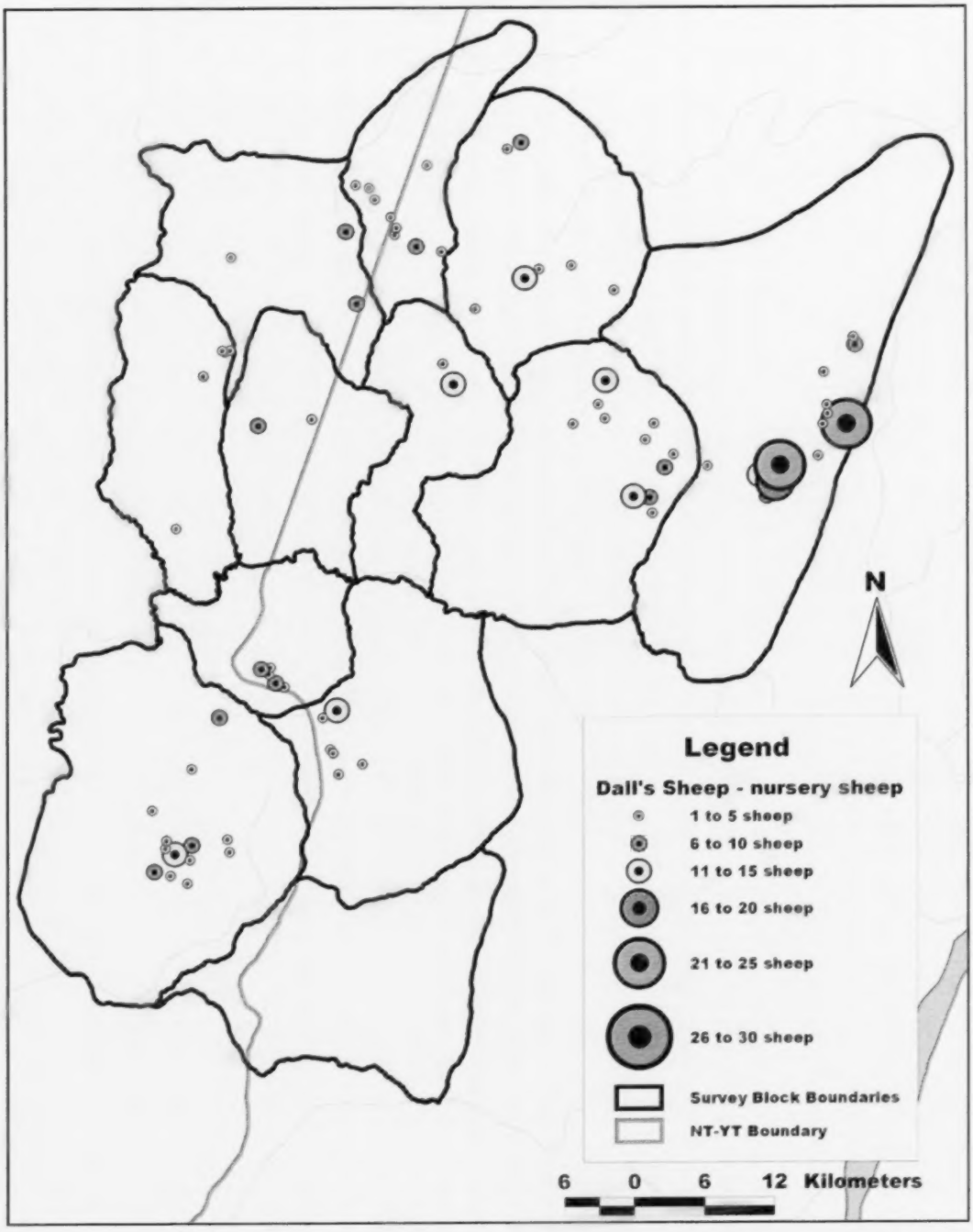

Figure 9. Distribution of nursery Dall's sheep in the northern Richardson Mountains, August 2003.

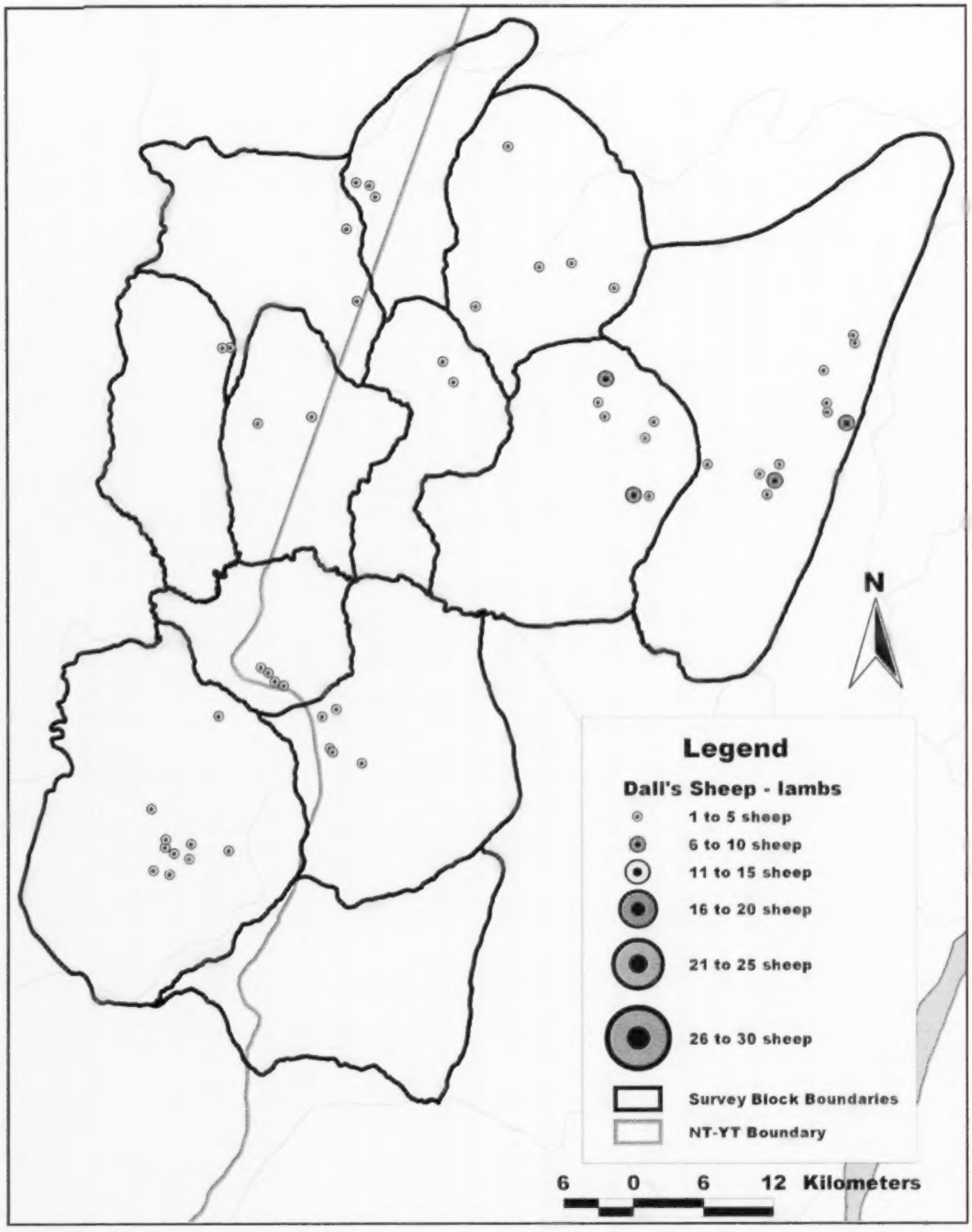

Figure 10. Distribution of lamb Dall's sheep in the northern Richardson Mountains, August 2003.

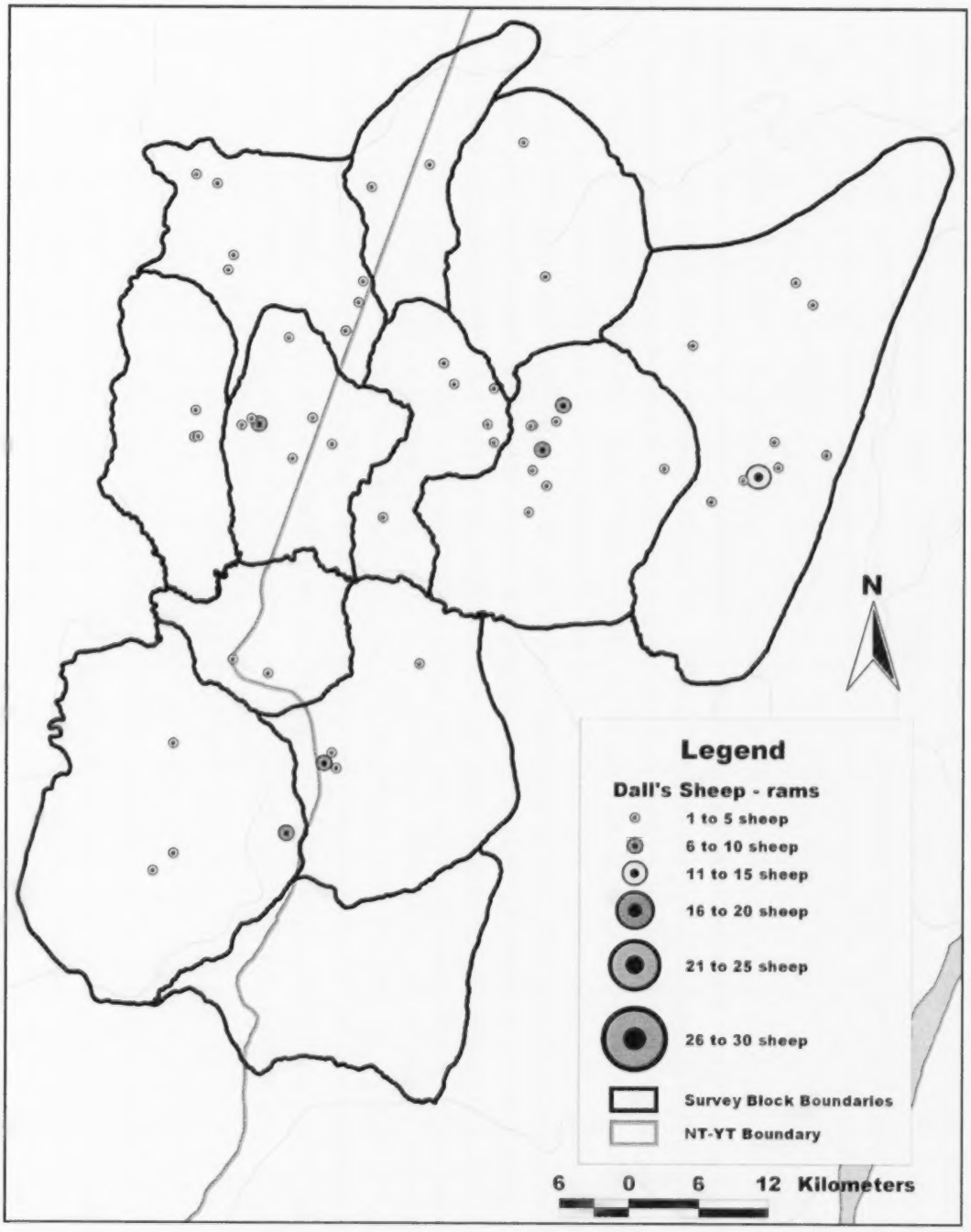

Figure 11. Distribution of ram Dall's sheep (half, three-quarter, and full curl) in the northern Richardson Mountains, August 2003.

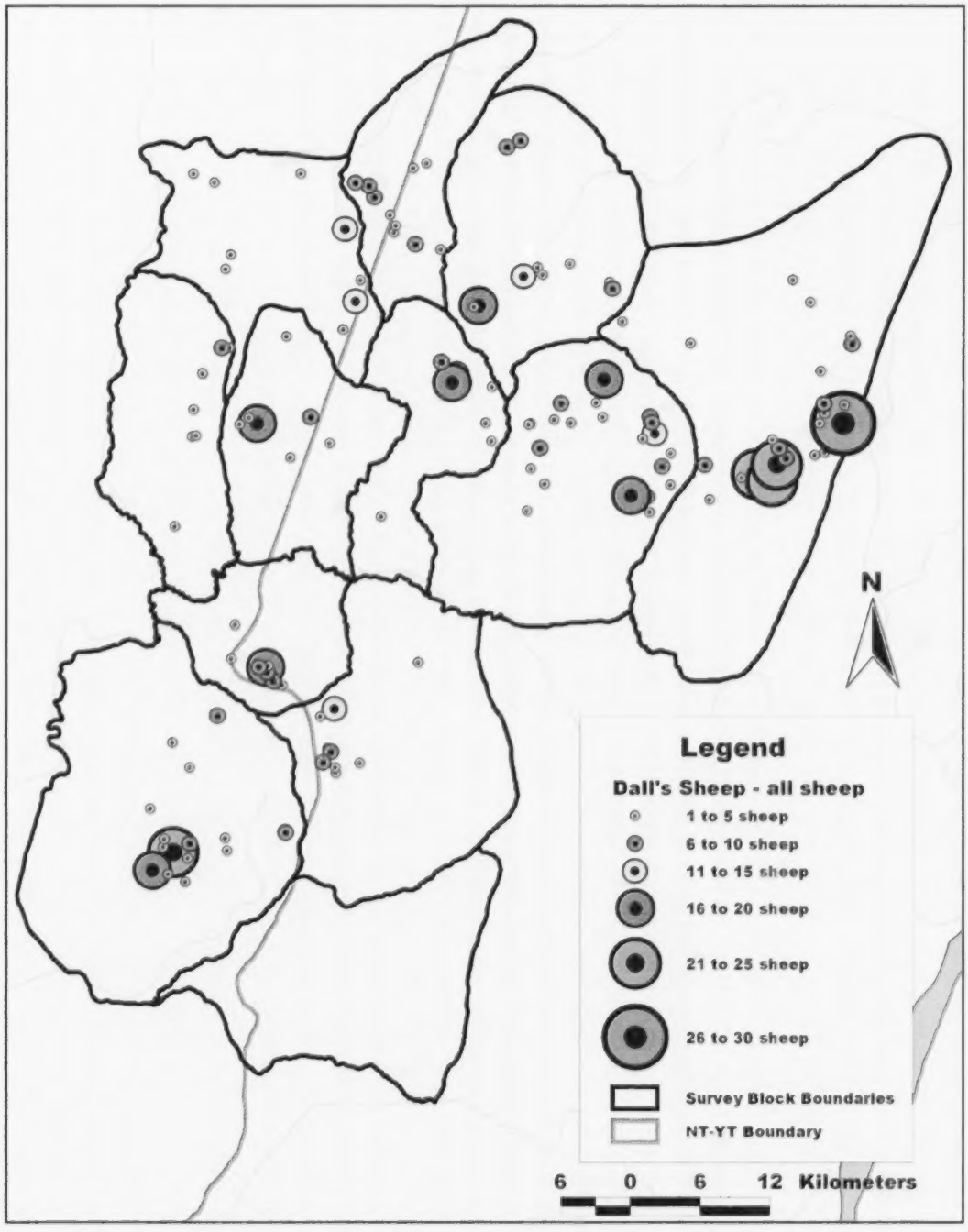

Figure 12. Distribution of Dall's sheep (nursery, lambs, and rams) in the northern Richardson Mountains, August 2003.

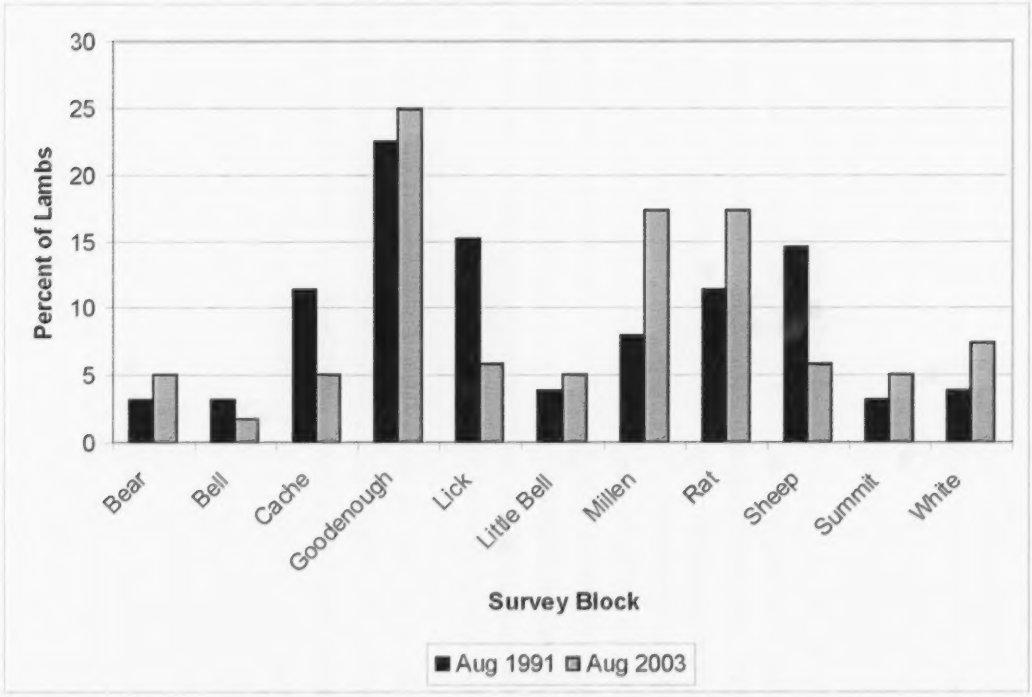

Figure 13. Percentage of the total number of lambs found in each blocks surveyed during August 1991 and 2003.

The proportion of the nursery sheep found in each block surveyed during August 1991 and August 2003 is given in Figure 14. The majority of the nursery sheep observed in 2003 were found in the Goodenough block (33%), followed by the Rat (13%) and Millen (12%) blocks. In comparison, the majority of the nursery sheep in 1991 were found in the Goodenough block (22%), followed by the Lick (15%), Sheep (13%), and Rat (10%) blocks.

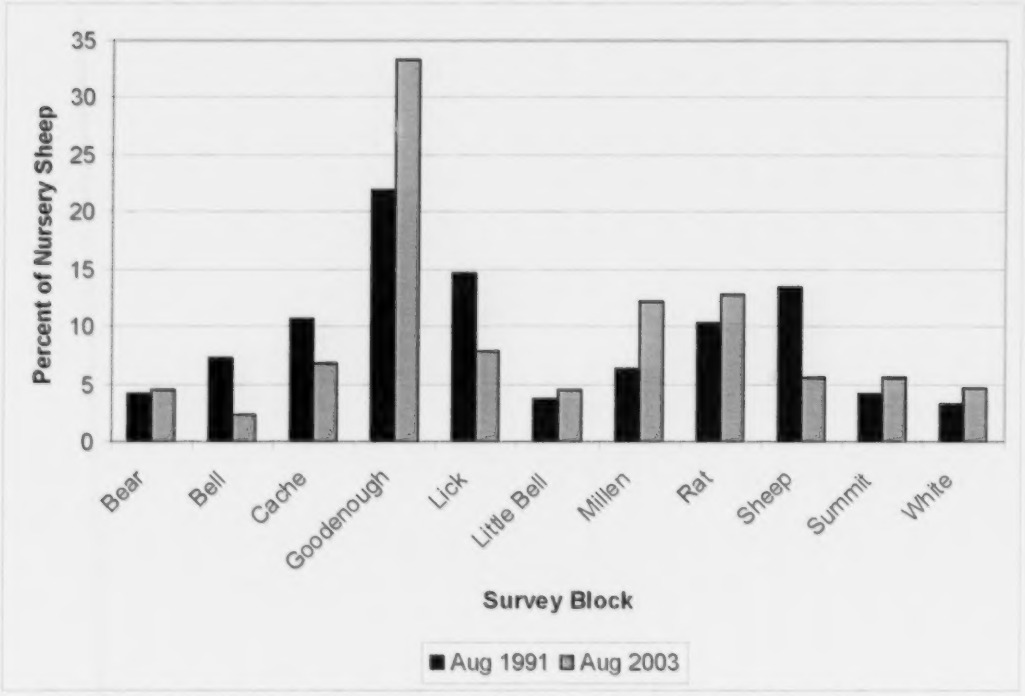

Figure 14. Percentage of the total number of nursery sheep found in each block surveyed during August 1991 and 2003.

The proportion of the half curl rams found in each block surveyed during August 1991 and August 2003 is given in Figure 15. The majority of the half curl rams observed in 2003 were found in the Bear (17%), Goodenough (17%), and Little Bell (17%) blocks. In comparison, the majority of half curl rams observed in 1991 were found in the Rat block (31%), while the Bear, Goodenough, Millen, and White blocks each had approximately 10% to 12% of the remaining half curl rams.

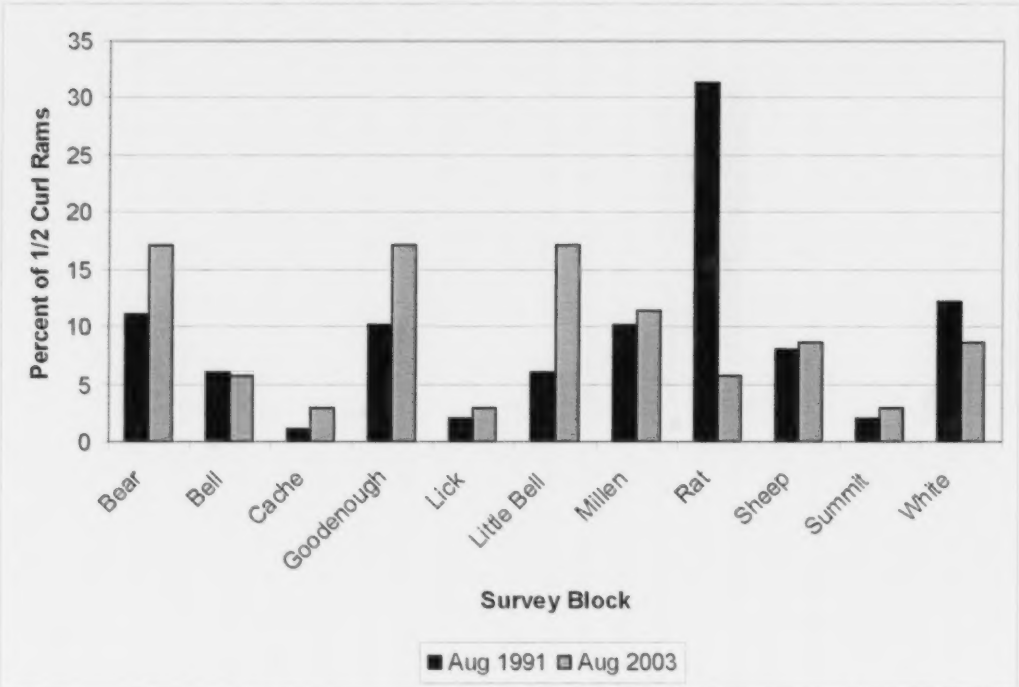

Figure 15. Percentage of the total number of half curl rams found in each block surveyed during August 1991 and 2003.

The proportion of the three-quarter curl rams found in each block surveyed during August 1991 and August 2003 is given in Figure 16. The majority of the three-quarter curl rams observed in 2003 were found in the Little Bell (24%), Goodenough (19%), Millen (14%), and Rat (14%) blocks. In comparison, the majority of the three-quarter rams in 1991 were observed in the Rat block (25%), while the Bear, Goodenough, Little Bell, and White blocks each had approximately 10% to 13% of the remaining three-quarter curl rams.

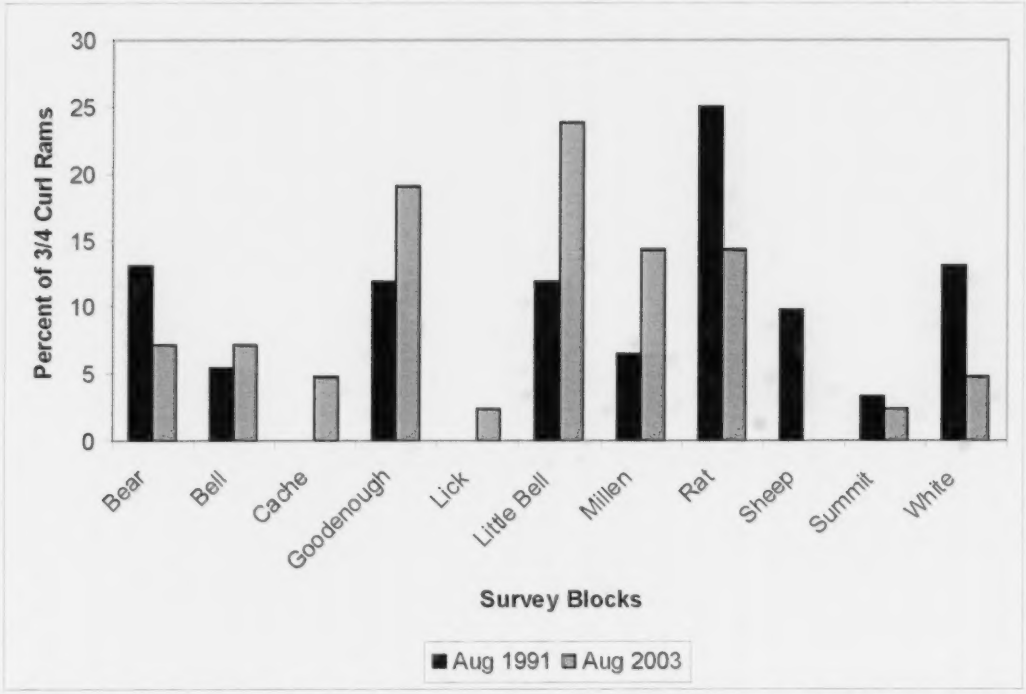

Figure 16. Percentage of the total number of three-quarter curl rams found in each block surveyed during August 1991 and 2003.

The proportion of full curl rams found in each block surveyed during August 1991 and August 2003 is given in Figure 17. The majority of full curl rams observed in 2003 were found in the Rat (24%) and Goodenough (21%) blocks, while the Little Bell, Millen, Sheep, and White blocks each had approximately 10% to 13% of the remaining full curl rams. The pattern was similar in 1991, with the majority of full curl rams found in the Rat block (27%), while the Goodenough, Little Bell, Millen, and White blocks each had approximately 12% to 16% of the remaining full curl rams.

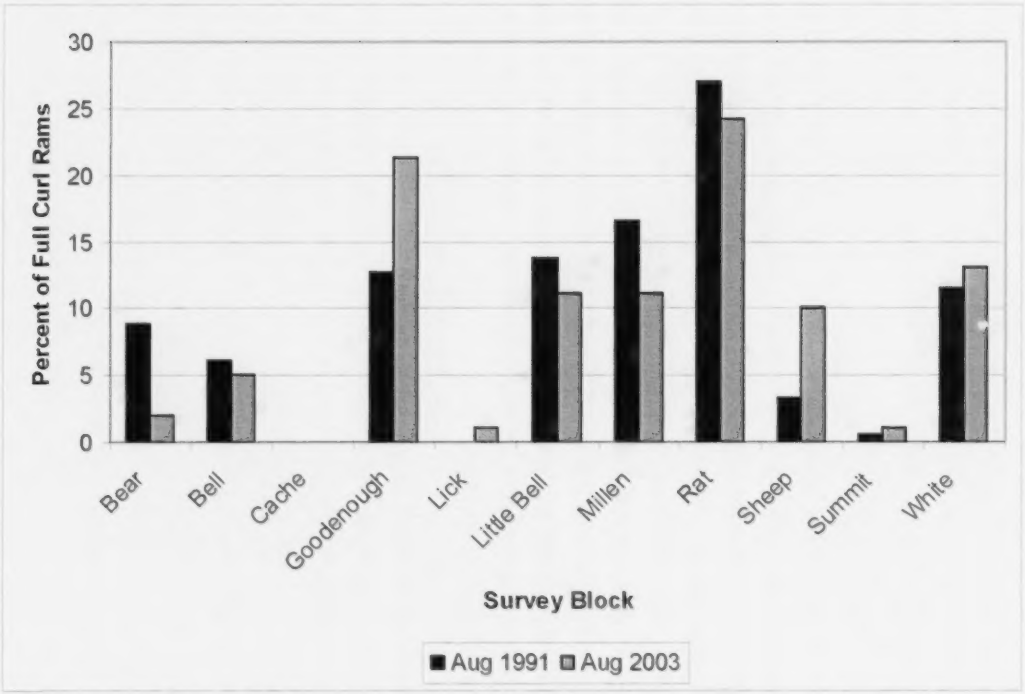

Figure 17. Percentage of the total number of full curl rams found in each blocks surveyed during August 1991 and 2003.

The majority of the nursery (74%), lambs (64%), half curl rams (56%), and full curl rams (62%) were found within the NT (Table 5). A total of 610 of the 847 (72%) sheep observed during the survey were found in the NT. This is consistent with observations made in 1991, 2001, and 2003 (Table 5).

The distribution and numbers of caribou, grizzly bears, golden eagles and muskox observed during that survey are shown in Figures 18 through 21.

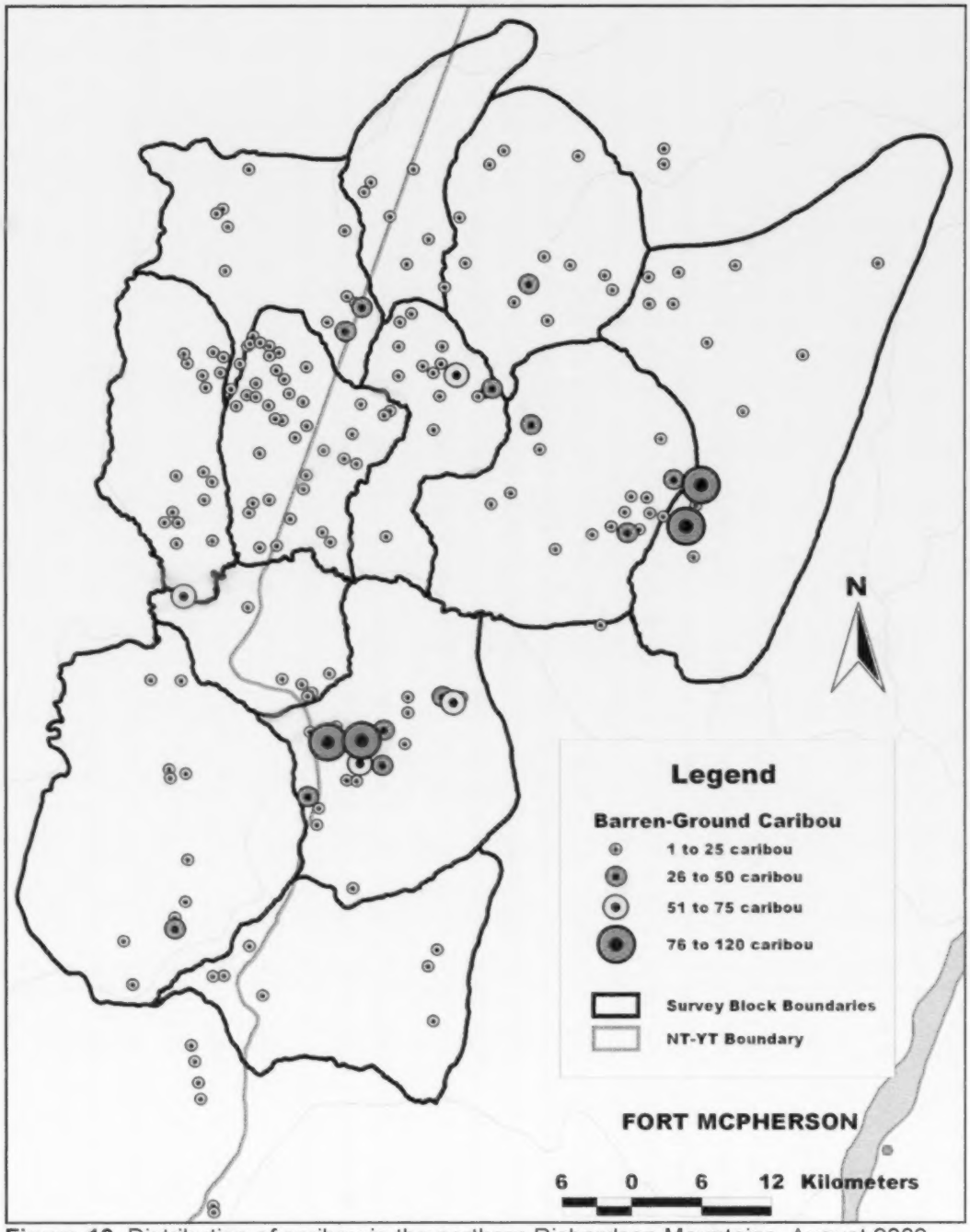

Figure 18. Distribution of caribou in the northern Richardson Mountains, August 2003.

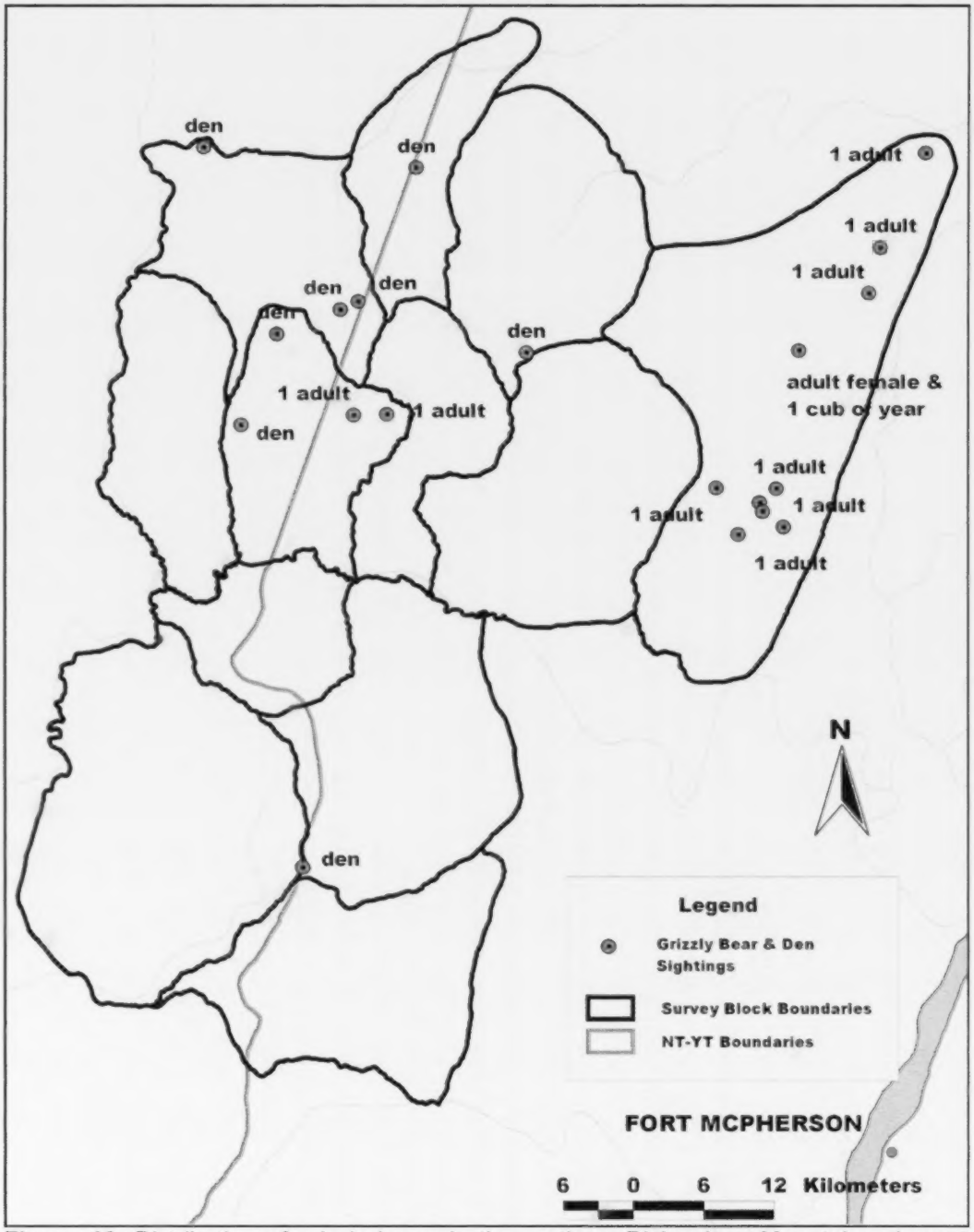

Figure 19. Distribution of grizzly bears in the northern Richardson Mountains, August 2003.

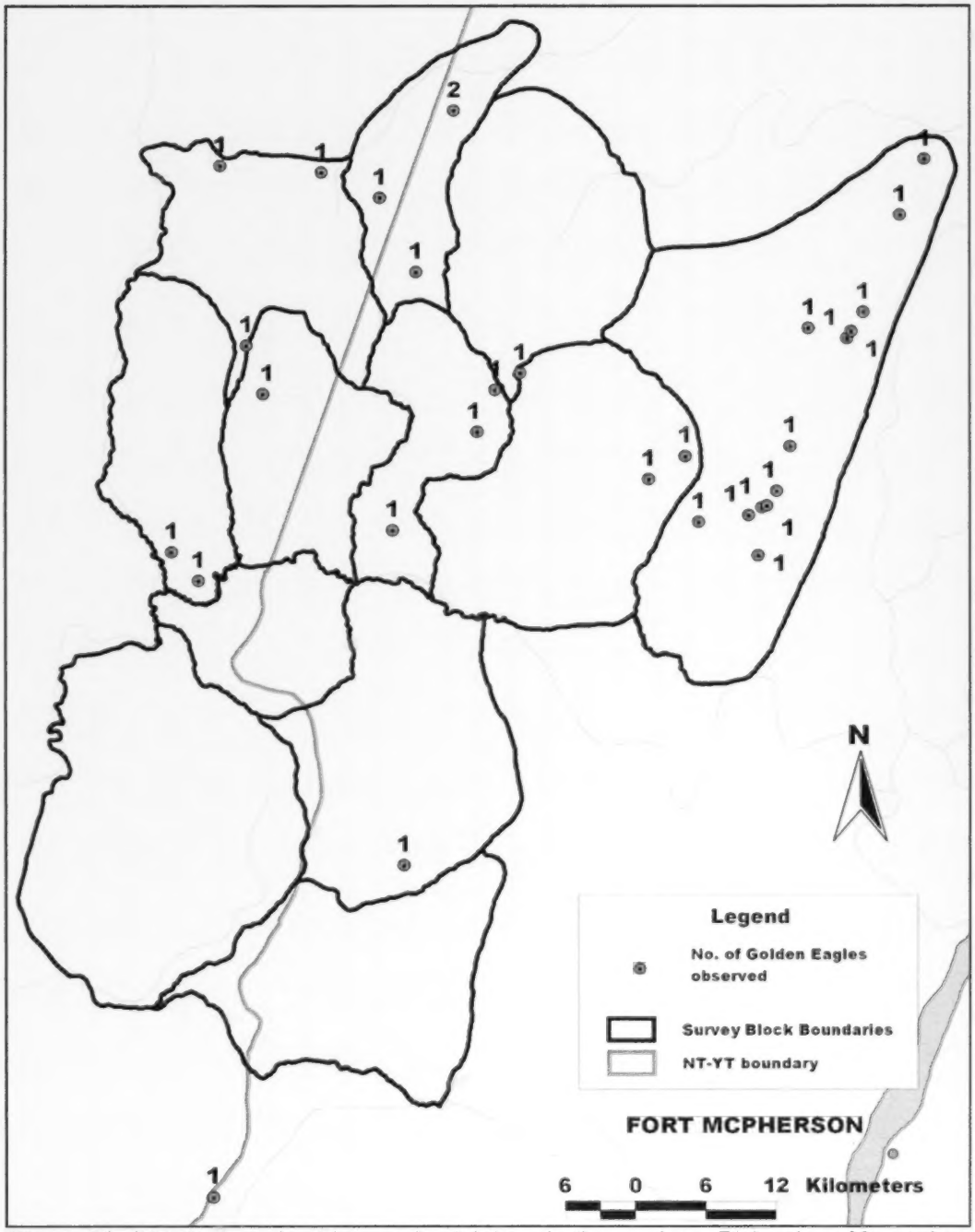

Figure 20. Distribution of golden eagle sightings in the northern Richardson Mountains, August 2003.

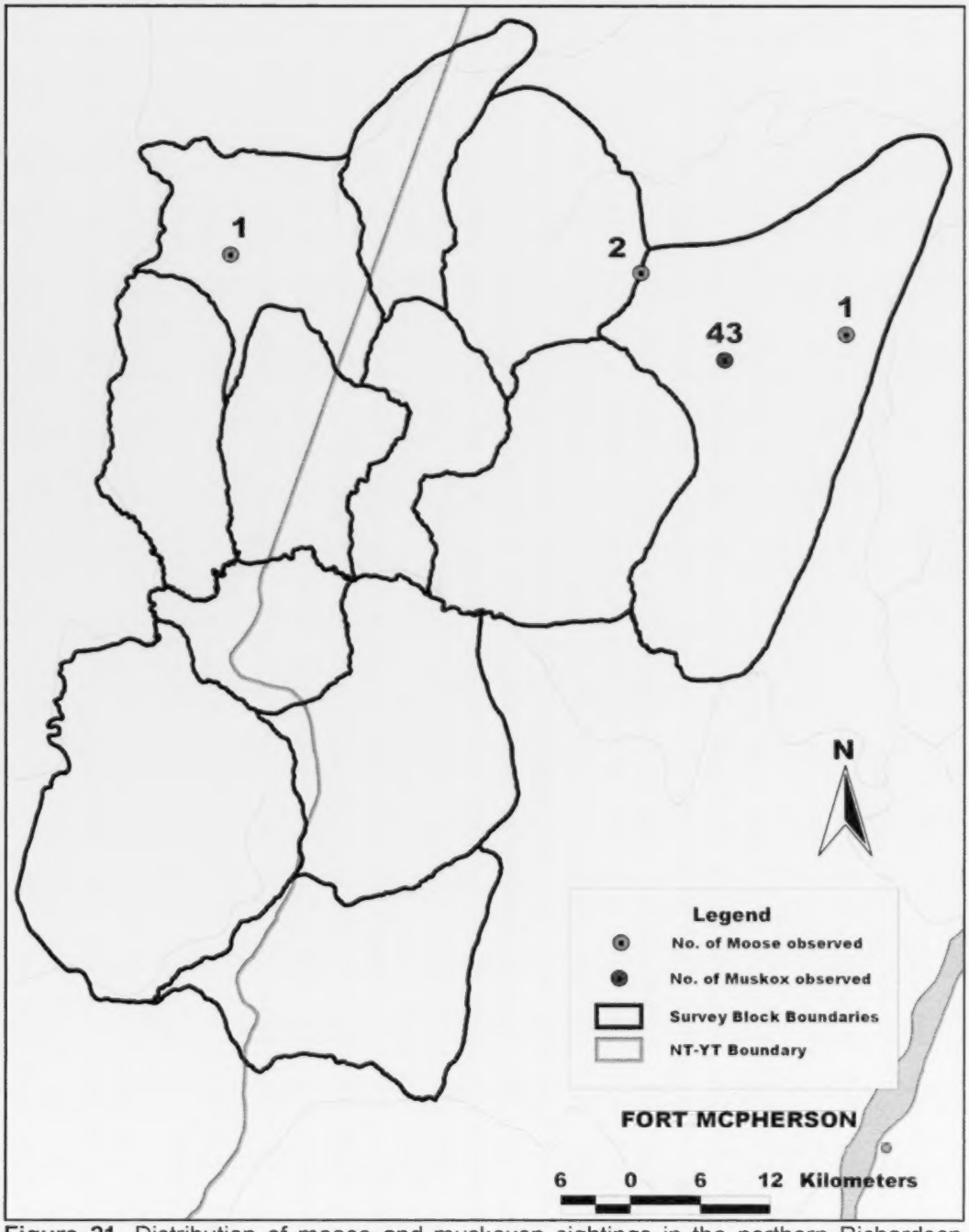

Figure 21. Distribution of moose and muskoxen sightings in the northern Richardson Mountains, August 2003.

Table 5. Number of Dall's sheep by class in the NT and YT, August 2003.

Year[1]	Class of Sheep	NWT		YT		Total
		No.	Percentage	No.	Percentage	
1991[2]	Nursery	494	73	184	27	**678**
	Lambs	215	75	71	25	**286**
	Half curl ram	65	66	34	34	**99**
	Three-quarter curl ram	58	63	34	37	**92**
	Full curl ram	95	52	87	48	**182**
	Total	964	70	410	30	**1,374**
1997[3]	Nursery	746	93	56	7	**802**
	Lambs	226	90	24	10	**250**
	Half curl ram	70	92	6	8	**76**
	Three-quarter curl ram	71	96	3	4	**74**
	Full curl ram	122	90	14	10	**136**
	Total	1241	92	103	8	**1,344**
2001[4]	Nursery	498	68	238	32	**736**
	Lambs	53	56	41	44	**94**
	Half curl ram	34	79	9	21	**43**
	Three-quarter curl ram	41	75	14	25	**55**
	Full curl ram	70	53	63	47	**133**
	Total	**696**	**66**	**365**	**34**	**1,061**
2003	Nursery	319	74	111	26	**430**
	Lambs	77	64	44	36	**121**
	Half curl ram	20	56	16	44	**36**
	Three-quarter curl ram	19	45	23	55	**42**
	Full curl ram	62	62	38	38	**100**
	Total	**610**	**72**	**237**	**28**	**847**

[1] The Bell, Millen, and White blocks were not surveyed in 1997. All blocks were surveyed in 1991, 2001, and 2003.
[2] Nagy and Carey 2013a.
[3] Nagy and Carey 2013b.
[4] Nagy et al. 2013.

DISCUSSION

The Dall's sheep population declined between 1997 and 2001. The results of the 2003 Richardson Mountains Dall's sheep survey indicate that this population has continued to decline between 2001 and 2003. The number of lambs per 100 nursery sheep was higher in 2003 than in 2001 suggesting that productivity or lamb survival has increased. However, the rate of 28.2 lambs per 100 nursery sheep is still relatively low, and is indicative of a stable or decreasing population. The number of rams in the population declined dramatically between 1991 and 2003. The low numbers of half and three-quarter curl rams suggest that recruitment to the full curl class will be relatively low during the next few years. As a result, the number of full curl rams in the population can be expected to decline over the next few years. The distribution of three-quarter and full curl rams during 2003 appears to be consistent with that observed during 2001.

ACKNOWLEDGEMENTS

James Edwards, Ehdiitat Renewable Resource Council (Aklavik, NT) and Graham Baird, Vuntut Gwichin First Nation (Old Crow, YT) assisted as observers during the survey. We thank Rob Fletcher, Trans North Helicopters (Inuvik, NT), for his excellent flying skills and assistance during the survey.

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APPENDIX A. Classification of Dall's sheep by sightings and survey block in the northern Richardson Mountains, August 2003.

Survey Block	Sighting	Latitude	Longitude	In/Out	Elevation	Group	Nursery Sheep	Lamb	Rams				Un-classified	Total
									Half Curl	Three-quarter Curl	Full Curl	Total		
Lick	5	68.01	-135.97	out			0	0	0	0	0	0	5	5
Lick	6	67.96	-136.21	out			0	0	0	0	0	0	19	19
White Mt	9	67.91	-136.46	in		1	0	0	0	0	3	3	0	3
White Mt	12	67.98	-136.52	in	4100	2	7	5	0	0	0	0	0	13
White Mt	18	67.87	-136.66	in	4000	4	2	1	0	0	0	0	0	3
White Mt	17	67.86	-136.67	in	3500	3	2	0	0	0	0	0	0	2
White Mt	20	67.94	-136.72	in	2800	5	2	0	0	0	3	3	0	5
White Mt	21	67.92	-136.72	in	2400	6	0	0	0	0	1	1	0	1
White Mt	25	67.98	-136.81	in	4700	7	0	0	3	0	0	3	0	3
White Mt	26	67.99	-136.85	in	2900	8	0	0	0	0	2	2	0	2
White Mt	27	68.01	-136.64	in	3500	9	0	0	0	0	0	0	1	1
	28	68.05	-136.43	out	4200	10	0	0	0	0	0	0	5	5
	29	68.05	-136.41	out	4500	11	1	0	1	0	0	1	0	2
White Mt	38	67.95	-136.46	in	3300	12	0	0	0	2	2	4	0	4
White Mt	40	67.93	-136.45	in	3600	13	7	3	0	0	2	2	0	12
L Bell	46	67.84	-136.46	in	3700	14	4	1	1	0	0	1	0	6
L Bell	46	67.84	-136.46	in	3700	14	5	4	0	0	0	0	0	9
L Bell	50	67.82	-136.40	in	3400	15	0	0	0	0	2	2	0	2
L Bell	56	67.80	-136.47	in	3300	16	0	0	1	3	0	4	0	4
	63	67.90	-136.21	out	3700	17	0	0	0	0	0	0	12	12
L Bell	66	67.82	-136.56	in	3800	18	10	1	2	3	2	7	0	18
L Bell	66	67.82	-136.56	in	3800	18	0	0	1	1	3	5	0	5
L Bell	73	67.81	-136.59	in	3000	19	0	0	0	0	4	4	0	4

Survey Block	Sighting	Latitude	Longitude	In/Out	Elevation	Group	Nursery Sheep	Lamb	Rams				Un-classified	Total
									Half Curl	Three-quarter Curl	Full Curl	Total		
L Bell	74	67.82	-136.58	in	3500	20	0	0	0	1	0	1	0	1
L Bell	83	67.89	-136.56	in	3600	21	0	0	1	2	0	3	0	3
Bell	95	67.86	-136.68	in	3800	22	4	2	0	0	0	0	0	6
Bell	97	67.84	-136.70	in	3800	23	1	0	0	0	0	0	0	1
Bell	98	67.79	-136.67	in	3900	24	0	0	0	0	2	2	0	2
	9	67.98	-135.92	out	3500	25	0	0	0	0	0	0	3	3
Bell	17	67.72	-136.64	in	2500	26	2	0	0	0	0	0	0	2
Bell	24	67.84	-136.69	in	2900	27	3	0	0	0	0	0	0	3
Bell	26	67.81	-136.69	in	4100	28a	0	0	2	1	2	5	0	5
Bell	27	67.79	-136.67	in	4200	28b	0	0	0	2	1	3	0	3
	30	67.64	-136.38	out	4000	29	0	0	0	0	0	0	20	20
Millen	32	67.59	-136.44	in	3500	30	7	2	0	0	0	0	0	9
Millen	37	67.56	-136.50	in	3700	31	0	0	0	2	3	5	0	5
Millen	41	67.55	-136.45	in	3300	32	2	0	0	0	0	0	0	2
Millen	42	67.51	-136.50	in	5600	33	1	1	0	0	0	0	0	2
Millen	57	67.48	-136.43	in	4400	34	13	5	3	0	1	4	0	22
Millen	60	67.48	-136.45	in	3900	35	4	1	0	0	0	0	0	5
Millen	61	67.49	-136.45	in	3000	36	2	3	0	0	0	0	0	5
Millen	62	67.52	-136.23	in	4300	37	0	0	0	3	5	8	0	8
Millen	63	67.50	-136.34	in	4900	38a	1	0	0	0	0	0	0	1
Millen	64	67.49	-136.33	in	3000	38b	1	1	0	0	0	0	0	2
Millen	65	67.49	-136.40	in	4000	39	8	2	0	0	0	0	0	10
Millen	66	67.48	-136.40	in	4200	40	1	1	0	0	0	0	0	2
Millen	67	67.46	-136.39	in	4400	41	1	0	0	0	0	0	0	1
Millen	70	67.46	-136.46	in	4600	42	9	4	1	1	2	4	0	17
Millen	72	67.46	-136.42	in		43	2	1	0	0	0	0	0	3
Lick	9	68.01	-135.96	in	3600	44	5	1	0	0	0	0	0	6

Survey Block	Sighting	Latitude	Longitude	In/Out	Elevation	Group	Nursery Sheep	Lamb	Rams				Un-classified	Total
									Half Curl	Three-quarter Curl	Full Curl	Total		
Lick	10	68.00	-136.12	in	4500	45	3	2	0	0	0	0	0	5
Lick	11	68.00	-136.11	in	3500	46	0	0	0	1	1	2	0	2
Lick	12	67.99	-136.14	in	3700	47	11	0	0	0	0	0	0	11
Lick	18	67.96	-136.22	in	4300	48	1	1	0	0	0	0	0	2
Lick	22	68.09	-136.26	in	3500	49	5	1	0	0	0	0	0	6
Lick	23	68.09	-136.24	in	3500	50	6	0	1	0	1	2	0	8
Lick	24	68.01	-136.06	in	3700	51	3	2	0	0	0	0	0	5
	27	67.92	-135.80	out	4300	52	0	0	0	0	0	0	9	9
	28	67.91	-135.78	out	4000	53	0	0	0	0	0	0	11	11
	29	67.87	-135.72	out	3000	54	0	0	0	0	0	0	4	4
Summit	38	67.63	-136.33	in	4000	55	3	2	0	0	0	0	0	5
Summit	39	67.63	-136.35	in	4300	56	6	2	0	0	0	0	0	8
Summit	40	67.64	-136.37	in	4200	57	4	1	1	1	0	2	0	7
Summit	41	67.64	-136.37	in	4400	58	4	0	0	0	0	0	0	4
Summit	42	67.64	-136.39	in	3600	59	7	1	0	0	0	0	0	8
Summit	43	67.64	-136.45	in	4300	60	0	0	0	0	1	1	0	1
Summit	44	67.66	-136.46	in	3800	61	0	0	0	0	0	0	3	3
Sheep	48	67.63	-136.22	in	3300	62	11	2	0	0	0	0	0	13
Sheep	52	67.62	-136.24	in	3800	63	1	1	0	0	0	0	0	2
Sheep	56	67.60	-136.20	in	3700	64	3	2	0	0	0	0	0	5
Sheep	57	67.59	-136.20	in	4000	65	4	1	1	0	0	1	0	6
Sheep	58	67.58	-136.20	in	4000	66	0	0	1	0	7	8	0	8
Sheep	59	67.58	-136.17	in	4000	67	3	0	0	0	0	0	0	3
Sheep	60	67.58	-136.18	in	4000	68	0	0	1	0	0	1	0	1
Sheep	63	67.59	-136.13	in	4300	69	2	1	0	0	0	0	0	3
Sheep	67	67.68	-136.09	in	4400	70	0	0	0	0	3	3	0	3
Bear	87	67.78	-136.26	in	3200	71	0	0	0	1	0	1	0	1

Survey Block	Sighting	Latitude	Longitude	In/Out	Elevation	Group	Nursery Sheep	Lamb	Rams				Un-classified	Total
									Half Curl	Three-quarter Curl	Full Curl	Total		
Bear	92	67.90	-136.21	in	3500	72	14	4	1	1	0	2	0	20
Bear	96	67.91	-136.24	in	3700	73	5	2	1	0	0	1	0	8
Cache	103	67.99	-136.32	in	3900	74	2	0	0	0	0	0	0	2
Cache	103	67.99	-136.32	in	4500	75	3	0	0	0	0	0	0	3
Cache	105	67.99	-136.37	in	5000	76	10	0	0	0	0	0	0	10
Cache	108	67.99	-136.42	in	4500	77	3	0	0	0	0	0	0	3
Cache	109	68.00	-136.43	in	4500	78	1	0	0	0	0	0	0	1
Cache	110	68.01	-136.44	in	4500	79	1	0	0	0	0	0	0	1
Cache	112	68.01	-136.49	in	3700	80	4	2	0	0	0	0	0	6
Cache	113	68.02	-136.51	in	3900	81	2	1	1	2	0	3	0	6
Cache	115	68.02	-136.53	in	4100	82	3	3	0	0	0	0	0	6
Bear	5	67.90	-136.13	in	3000	83	0	0	2	0	0	2	0	2
Bear	6	67.87	-136.12	in	3400	84	0	0	2	0	0	2	0	2
Bear	7	67.86	-136.09	in	3600	85	0	0	0	1	2	3	0	3
Rat	11	67.91	-135.99	in	4100	86	0	0	0	1	6	7	0	7
Rat	14	67.94	-135.92	in	3600	87	11	6	0	0	0	0	0	17
Rat	15	67.92	-135.92	in	3800	88	3	2	0	0	0	0	0	5
Rat	16	67.91	-135.90	in	3900	89	1	1	0	0	0	0	0	2
Rat	17	67.87	-136.00	in	3700	90	0	0	0	0	9	9	0	9
Rat	18	67.89	-136.03	in	3800	91	0	0	0	0	3	3	0	3
Rat	19	67.84	-135.96	in	4000	92	0	0	0	2	1	3	0	3
Rat	21	67.82	-135.98	in	3500	93	0	0	0	0	1	1	0	1
Rat	24	67.85	-136.00	in	3700	94	0	0	0	2	1	3	0	3
Rat	25	67.88	-136.03	in	3900	95	0	0	0	0	3	3	0	3
Rat	26	67.89	-135.99	in	3100	96	0	0	1	1	0	2	0	2
Rat	27	67.90	-135.95	in	3600	97	4	0	0	0	0	0	0	4
Goodenough	34	68.06	-135.62	in	1400	98	0	0	0	0	1	1	0	1

Survey Block	Sighting	Latitude	Longitude	In/Out	Elevation	Group	Nursery Sheep	Lamb	Rams				Un-classified	Total
									Half Curl	Three-quarter Curl	Full Curl	Total		
Goodenough	35	68.04	-135.57	in		99	0	0	0	0	4	4	0	4
Goodenough	38	67.98	-135.77	in	3500	100	0	0	0	1	1	2	0	2
Rat	43	67.90	-135.74	in	3700	101	2	0	0	0	0	0	0	2
Rat	45	67.86	-135.76	in	3500	102	6	1	0	0	0	0	0	7
Rat	46	67.85	-135.74	in	3300	103	1	0	0	0	0	0	0	1
Rat	52	67.86	-135.79	in	3300	105	13	6	0	0	0	0	0	19
Rat	52	67.86	-135.79	in	3800	104	1	0	0	0	0	0	0	1
Rat	54	67.89	-135.75	in	3900	106	6	0	1	0	0	1	0	7
Rat	55	67.90	-135.80	in	3500	107	2	1	0	0	0	0	0	3
Rat	58	67.92	-135.80	in	4100	109	5	4	0	0	0	0	0	9
Goodenough	60	67.90	-135.67	in	1900	110	5	1	0	0	0	0	0	6
Goodenough	61	67.87	-135.63	in	2000	111	0	0	2	0	0	2	0	2
Goodenough	72	67.90	-135.56	in	3000	112	11	1	1	3	7	11	0	23
Goodenough	74	67.90	-135.59	in	2500	113	0	0	2	0	2	4	0	4
Goodenough	76	67.89	-135.53	in	2500	115	4	1	0	0	0	0	0	5
Goodenough	76	67.89	-135.53	in	2300	114	7	1	0	0	0	0	0	8
Goodenough	77	67.90	-135.53	in	2500	116	18	7	0	0	0	0	0	25
Goodenough	78	67.91	-135.53	in	3100	118	22	2	1	0	0	1	0	25
Goodenough	78	67.91	-135.53	in	3100	120	3	1	0	0	0	0	0	4
Goodenough	78	67.91	-135.53	in	3100	117	16	2	0	0	0	0	0	18
Goodenough	78	67.91	-135.53	in	3100	119	12	0	0	0	0	0	0	12
Goodenough	81	67.93	-135.46	in	900	121	4	0	0	0	0	0	0	4
Goodenough	83	67.92	-135.51	in	700	122	0	0	0	0	0	0	9	9
Goodenough	84	67.93	-135.53	in	1000	123	0	0	0	0	0	0	6	6
Goodenough	85	67.93	-135.55	in	1800	124	0	0	0	2	3	5	0	5
Goodenough	86	67.94	-135.44	in	1800	125	0	0	0	2	3	5	0	5
Goodenough	87	67.96	-135.43	in	1800	126	22	8	0	0	0	0	0	30

Survey Block	Sighting	Latitude	Longitude	In/Out	Elevation	Group	Nursery Sheep	Lamb	Rams				Un-classified	Total
									Half Curl	Three-quarter Curl	Full Curl	Total		
Goodenough	88	67.98	-135.43	in	1800	127	0	0	0	0	0	0	4	4
Goodenough	89	67.96	-135.47	in	2800	128	5	0	0	0	0	0	0	5
Goodenough	90	67.96	-135.47	in		129	3	1	0	0	0	0	0	4
Goodenough	91	67.97	-135.48	in	2100	130	1	1	0	0	0	0	6	8
Goodenough	92	68.00	-135.50	in	1800	131	2	2	0	0	0	0	0	4
Goodenough	93	68.02	-135.46	in	1800	132	6	1	0	0	0	0	0	7
Goodenough	94	68.03	-135.47	in	1700	133	2	1	0	0	0	0	0	3

APPENDIX B. Classification of grizzly bears observed in the northern Richardson Mountains, August and September 2003.

Sighting	Latitude	Longitude	Date	Elevation	Comment
11	67.92	-136.48	26-Aug-03		den
28	68.05	-136.43	26-Aug-03	2600	den
34	68.01	-136.85	26-Aug-03		den
40	67.93	-136.45	26-Aug-03	3600	den
45	67.86	-136.32	26-Aug-03	3300	1 adult
59	67.85	-136.38	26-Aug-03		1 adult
62	67.94	-136.09	26-Aug-03	3500	den
73	67.81	-136.59	26-Aug-03	3000	den
84	67.89	-136.58	26-Aug-03	3600	den
3	68.18	-135.45	30-Aug-03	1000	1 adult
81	67.50	-136.18	30-Aug-03	3600	den
36	68.00	-135.57	31-Aug-03	1800	adult female and 1 cub of year
7	67.88	-135.64	13-Sep-03	1700	1 adult
10	67.85	-135.57	13-Sep-03	1400	1 adult
13	67.88	-135.55	13-Sep-03	1800	1 adult
14	67.88	-135.53	13-Sep-03	1900	1 adult
38	68.10	-135.48	13-Sep-03	1500	1 adult
45	67.87	-135.48	13-Sep-03	1700	1 adult
47	67.90	-135.52	13-Sep-03	2600	1 adult
67	68.06	-135.47	13-Sep-03	1300	1 adult

APPENDIX C. Classification of caribou observed during the northern Richardson Mountains Dall's sheep survey, August and September 2003.

Sighting	Latitude	Longitude	Date	Elevation	Adults	Bulls	Cows	Calves	Unclassified	Total
3	68.04	-135.85	26-Aug-03		3					3
4	68.02	-135.90	26-Aug-03		7					7
9	67.91	-136.46	26-Aug-03						20	20
10	67.91	-136.49	26-Aug-03			5				5
12	67.98	-136.52	26-Aug-03	3600					2	2
13	67.86	-136.63	26-Aug-03	3500	12					12
14	67.84	-136.63	26-Aug-03						2	2
14	67.84	-136.63	26-Aug-03						5	5
14	67.84	-136.63	26-Aug-03						4	4
15	67.85	-136.66	26-Aug-03	3300					9	9
16	67.86	-136.67	26-Aug-03	3500		3	2	3		8
19	67.87	-136.63	26-Aug-03						5	5
21	67.92	-136.72	26-Aug-03						8	8
22	67.96	-136.75	26-Aug-03	3000					2	2
23	67.96	-136.78	26-Aug-03						9	9
24	67.97	-136.77	26-Aug-03	3200					7	7
28	68.05	-136.43	26-Aug-03						2	2
30	68.07	-136.29	26-Aug-03	4100					2	2
31	68.11	-135.95	26-Aug-03	3100					15	15
32	68.12	-135.96	26-Aug-03						6	6
33	68.10	-136.12	26-Aug-03				5	5		10
36	68.00	-136.75	26-Aug-03	3300					10	10
39	67.94	-136.47	26-Aug-03	3600					8	8
40	67.93	-136.45	26-Aug-03						12	12

Sighting	Latitude	Longitude	Date	Elevation	Adults	Bulls	Cows	Calves	Unclassified	Total
41	67.93	-136.44	26-Aug-03	3400					30	30
42	67.91	-136.45	26-Aug-03	3500					40	40
43	67.91	-136.45	26-Aug-03	3500					20	20
44	67.86	-136.31	26-Aug-03	3300					8	8
45	67.86	-136.32	26-Aug-03	3500					12	12
47	67.83	-136.46	26-Aug-03						20	20
48	67.83	-136.37	26-Aug-03	3500					4	4
49	67.81	-136.37	26-Aug-03	3300					6	6
51	67.82	-136.41	26-Aug-03	3300					5	5
52	67.79	-136.43	26-Aug-03	3300					2	2
53	67.75	-136.34	26-Aug-03	2300		11				11
54	67.75	-136.36	26-Aug-03						25	25
55	67.76	-136.43	26-Aug-03	3500		4				4
55	67.76	-136.43	26-Aug-03	3500		2				2
57	67.82	-136.47	26-Aug-03	3600		1				1
58	67.83	-136.51	26-Aug-03	3900					3	3
61	68.01	-135.84	26-Aug-03						15	15
63	67.90	-136.21	26-Aug-03						60	60
64	67.86	-136.37	26-Aug-03	3700					1	1
65	67.83	-136.53	26-Aug-03	3800		3				3
67	67.77	-136.48	26-Aug-03	3800		3				3
68	67.73	-136.44	26-Aug-03	2500					15	15
69	67.73	-136.47	26-Aug-03	3800					9	9
70	67.75	-136.51	26-Aug-03	2700					2	2
71	67.76	-136.51	26-Aug-03	2600					22	22
72	67.80	-136.53	26-Aug-03	3400					20	20
75	67.83	-136.61	26-Aug-03	3000					9	9
76	67.84	-136.60	26-Aug-03	3200		unk				0

Sighting	Latitude	Longitude	Date	Elevation	Adults	Bulls	Cows	Calves	Unclassified	Total
77	67.84	-136.58	26-Aug-03	3300					3	3
78	67.83	-136.55	26-Aug-03	3800					11	11
80	67.85	-136.59	26-Aug-03						5	5
81	67.88	-136.63	26-Aug-03						12	12
82	67.88	-136.62	26-Aug-03						10	10
85	67.88	-136.61	26-Aug-03	3600					15	15
86	67.88	-136.59	26-Aug-03	3700					5	5
87	67.88	-136.56	26-Aug-03	3800					5	5
87	67.88	-136.56	26-Aug-03	3800					1	1
88	67.86	-136.56	26-Aug-03	3700					8	8
89	67.86	-136.54	26-Aug-03	3900					11	11
90	67.85	-136.52	26-Aug-03	3900					21	21
91	67.85	-136.48	26-Aug-03	3900					8	8
92	67.87	-136.50	26-Aug-03	3800					10	10
93	67.87	-136.58	26-Aug-03	3700					14	14
96	67.86	-136.69	26-Aug-03	4500					4	4
99	67.77	-136.63	26-Aug-03	3300					8	8
100	67.76	-136.60	26-Aug-03	3300					4	4
101	67.72	-136.56	26-Aug-03	2800					13	13
102	67.71	-136.63	26-Aug-03	2600					6	6
103	67.67	-136.58	26-Aug-03	2000					75	75
103	67.67	-136.58	26-Aug-03	2000					25	25
103	67.67	-136.58	26-Aug-03	2000					10	10
104	67.63	-136.27	26-Aug-03	3500					6	6
105	67.75	-135.76	26-Aug-03	1500					6	6
8	68.05	-135.74	29-Aug-03	2000					1	1
10	67.90	-136.14	29-Aug-03	3300			1	1		2
11	67.89	-136.15	29-Aug-03	3300			3	1		4

Sighting	Latitude	Longitude	Date	Elevation	Adults	Bulls	Cows	Calves	Unclassified	Total
12	67.81	-136.34	29-Aug-03	1800			1	1		2
13	67.78	-136.42	29-Aug-03	1900			6			6
18	67.73	-136.64	29-Aug-03	2500					10	10
19	67.72	-136.67	29-Aug-03	2800		1	1	1		3
20	67.73	-136.66	29-Aug-03	2600					24	24
21	67.76	-136.68	29-Aug-03	3600		6	2			8
22	67.85	-136.73	29-Aug-03	3600			1			1
23	67.85	-136.75	29-Aug-03	4000					7	7
24	67.84	-136.69	29-Aug-03	2900		4				4
25	67.83	-136.68	29-Aug-03	3500					8	8
28	67.75	-136.61	29-Aug-03	2500		1				1
35	67.61	-136.53	29-Aug-03	3000					1	1
36	67.60	-136.59	29-Aug-03	2800					25	25
38	67.54	-136.49	29-Aug-03	3400		1				1
39	67.53	-136.48	29-Aug-03	3500					2	2
40	67.54	-136.46	29-Aug-03	3500					9	9
44	67.42	-136.37	29-Aug-03						25-30	0
46	67.23	-136.12	29-Aug-03	4500					7	7
49	67.23	-136.12	29-Aug-03	4600		21				21
51	67.32	-136.23	29-Aug-03	3600		7				7
50	67.31	-136.21	29-Aug-03	3600					21	21
52	67.33	-136.25	29-Aug-03	3500					2	2
53	67.34	-136.27	29-Aug-03	3700					9	9
54	67.37	-136.42	29-Aug-03	3000					8	8
56	67.40	-136.46	29-Aug-03	3300					6	6
66	67.48	-136.40	29-Aug-03	4000					9	9
68	67.45	-136.37	29-Aug-03	3700					4	4
69	67.43	-136.38	29-Aug-03	3900		23				23

Sighting	Latitude	Longitude	Date	Elevation	Adults	Bulls	Cows	Calves	Unclassified	Total
74	67.40	-136.27	29-Aug-03	3200		8				8
75	67.40	-136.25	29-Aug-03	3200		4				4
76	67.43	-136.22	29-Aug-03	3900		1				1
77	67.40	-136.17	29-Aug-03	3500		8				8
78	67.42	-135.83	29-Aug-03	2500					3	3
79	67.46	-135.87	29-Aug-03	3500		15				15
80	67.47	-135.87	29-Aug-03	3400					10	10
5	68.09	-135.47	30-Aug-03						unk	0
8	68.01	-135.99	30-Aug-03	3000					8	8
9	68.01	-135.96	30-Aug-03	3600					13	13
15	67.99	-136.13	30-Aug-03	4000					>30	0
16	67.97	-136.07	30-Aug-03	3900					25	25
17	67.97	-136.15	30-Aug-03	4300					10	10
20	68.02	-136.31	30-Aug-03	4500					10-15	0
21	68.08	-136.27	30-Aug-03	4200					unk	0
24	68.01	-136.06	30-Aug-03	3700					12	12
25	68.01	-136.12	30-Aug-03	4200					3	3
30	67.85	-135.67	30-Aug-03	3000					>100	0
31	67.83	-135.63	30-Aug-03	2900				1		1
34	67.65	-136.25	30-Aug-03	3000					1	1
35	67.63	-136.28	30-Aug-03	3000					10	10
36	67.64	-136.30	30-Aug-03	3000					12	12
37	67.64	-136.34	30-Aug-03	4000					8	8
45	67.68	-136.45	30-Aug-03	3000					11	11
51	67.61	-136.20	30-Aug-03	3200					5	5
53	67.60	-136.25	30-Aug-03	3400					6	6
54	67.60	-136.23	30-Aug-03	3500					14	14
55	67.60	-136.21	30-Aug-03	3100					100	100

Sighting	Latitude	Longitude	Date	Elevation	Adults	Bulls	Cows	Calves	Unclassified	Total
61	67.58	-136.15	30-Aug-03	3700					4	4
62	67.58	-136.13	30-Aug-03	4100					9	9
63	67.59	-136.13	30-Aug-03	4000					70	70
64	67.61	-136.15	30-Aug-03	3600					>100	0
65	67.65	-136.08	30-Aug-03	3400					18	18
66	67.66	-136.02	30-Aug-03	3700					32	32
68	67.67	-135.98	30-Aug-03	3500					15	15
69	67.66	-135.99	30-Aug-03	3500					65	65
70	67.64	-136.08	30-Aug-03	3900					10	10
71	67.62	-136.11	30-Aug-03	4200					25-30	0
72	67.62	-136.06	30-Aug-03	3700					4	4
73	67.60	-136.09	30-Aug-03	3600					30	30
80	67.50	-136.06	30-Aug-03	3700					2	2
82	67.54	-136.17	30-Aug-03	2300					2	2
83	67.55	-136.18	30-Aug-03	4000					20	20
84	67.56	-136.21	30-Aug-03	3900					35-40	0
89	67.77	-136.23	30-Aug-03	2800					2	2
90	67.86	-136.21	30-Aug-03	3500					6	6
91	67.88	-136.22	30-Aug-03	3800					2	2
93	67.90	-136.25	30-Aug-03	3600					9	9
94	67.89	-136.32	30-Aug-03	3600					6	6
95	67.90	-136.28	30-Aug-03	3500					1	1
96	67.91	-136.24	30-Aug-03	3700					10	10
97	67.92	-136.25	30-Aug-03	4200					23	23
98	67.91	-136.34	30-Aug-03	3700					5	5
99	67.93	-136.35	30-Aug-03	3600					>6	0
100	67.94	-136.34	30-Aug-03	3750					23	23
101	67.97	-136.29	30-Aug-03	3500					2	2

Sighting	Latitude	Longitude	Date	Elevation	Adults	Bulls	Cows	Calves	Unclassified	Total
102	67.99	-136.27	30-Aug-03	4200					1	1
104	68.00	-136.35	30-Aug-03	4300					1	1
107	67.97	-136.38	30-Aug-03	4500					6	6
110	68.01	-136.44	30-Aug-03	4500					10	10
114	68.02	-136.51	30-Aug-03	3900					1	1
116	68.03	-136.50	30-Aug-03	3800					6	6
5	67.90	-136.13	31-Aug-03						29	29
17	67.87	-136.00	31-Aug-03	3700		4				4
18	67.89	-136.03	31-Aug-03	3500					30	30
20	67.80	-135.90	31-Aug-03	3100					2	2
22	67.82	-136.05	31-Aug-03	3500					6	6
23	67.83	-136.02	31-Aug-03	3600					20	20
37	67.99	-135.74	31-Aug-03	3300					2	2
39	68.00	-135.88	31-Aug-03	3600					5	5
44	67.88	-135.72	31-Aug-03						40	40
45	67.86	-135.76	31-Aug-03						25	25
46	67.85	-135.74	31-Aug-03						15	15
47	67.83	-135.75	31-Aug-03	3700					10	10
48	67.83	-135.77	31-Aug-03	3800					>50	0
49	67.82	-135.84	31-Aug-03	3800					1	1
50	67.83	-135.81	31-Aug-03	3500					2	2
51	67.84	-135.79	31-Aug-03	3800					4	4
52	67.86	-135.79	31-Aug-03	3300					10	10
57	67.91	-135.77	31-Aug-03			>10				0
62	67.87	-135.66	31-Aug-03	1800					15	15
63	67.85	-135.71	31-Aug-03	2700					7	7
64	67.85	-135.69	31-Aug-03	2200					25	25
71	68.00	-135.55	31-Aug-03	2700					>16	0

Sighting	Latitude	Longitude	Date	Elevation	Adults	Bulls	Cows	Calves	Unclassified	Total
73	67.88	-135.66	31-Aug-03	2400					120	120
75	67.95	-135.63	31-Aug-03	3000					6	6

APPENDIX D. Classification of moose and muskoxen observed during the northern Richardson Mountains Dall's sheep survey, August and September 2003.

Species	Latitude	Longitude	Date	Elevation	Adults	Bulls	Cows	Calves	Unclassified	Total
Moose	67.94	-136.72	26-Aug-03			1				1
Moose	68.28	-134.12	29-Aug-03				1	2		3
Moose	68.23	-134.89	29-Aug-03				1			1
Moose	68.24	-134.87	29-Aug-03		1					1
Moose	68.19	-135.35	31-Aug-03				1	1		2
Moose	68.22	-135.24	31-Aug-03						1	1
Moose	68.02	-135.92	13-Sep-03	2,500		1	1			2
Moose	68.03	-135.48	13-Sep-03	1,000		1				1
Muskox	67.98	-135.70	31-Aug-03	2,500	35			8		43

APPENDIX E. Classification of golden eagles observed during the northern Richardson Mountains Dall's sheep survey, August and September 2003.

Sighting	Latitude	Longitude	Date	Elevation	Number
35	68.00	-136.81	26-Aug-03		1
37	68.02	-136.61	26-Aug-03		1
60	67.92	-136.09	26-Aug-03		1
79	67.84	-136.57	26-Aug-03		1
94	67.87	-136.64	26-Aug-03		1
15	67.69	-136.57	29-Aug-03	2,700	1
16	67.70	-136.64	29-Aug-03	2,500	1
45	67.24	-136.13	29-Aug-03	4,700	1
4	68.18	-135.45	30-Aug-03		1
78	67.53	-135.99	30-Aug-03	2,500	1
88	67.77	-136.23	30-Aug-03		1
106	67.97	-136.36	30-Aug-03	5,000	1
111	68.02	-136.48	30-Aug-03		1
117	68.10	-136.40	30-Aug-03		2
5	67.90	-136.13	31-Aug-03		1
8	67.87	-136.14	31-Aug-03		1
42	67.90	-135.72	31-Aug-03		1
53	67.87	-135.78	31-Aug-03		1
65	67.88	-135.54	31-Aug-03		1
6	68.02	-135.57	13-Sep-03		1
9	67.85	-135.65	13-Sep-03		1
12	67.84	-135.52	13-Sep-03		1
22	68.17	-135.08	13-Sep-03		1
29	67.93	-135.53	13-Sep-03		1
33	68.03	-135.49	13-Sep-03		1

Sighting	Latitude	Longitude	Date	Elevation	Number
36	68.05	-135.47	13-Sep-03		1
44	67.87	-135.56	13-Sep-03		1
46	67.88	-135.53	13-Sep-03		1
47	67.90	-135.52	13-Sep-03		1
66	68.03	-135.48	13-Sep-03		1
69	68.13	-135.47	13-Sep-03		1